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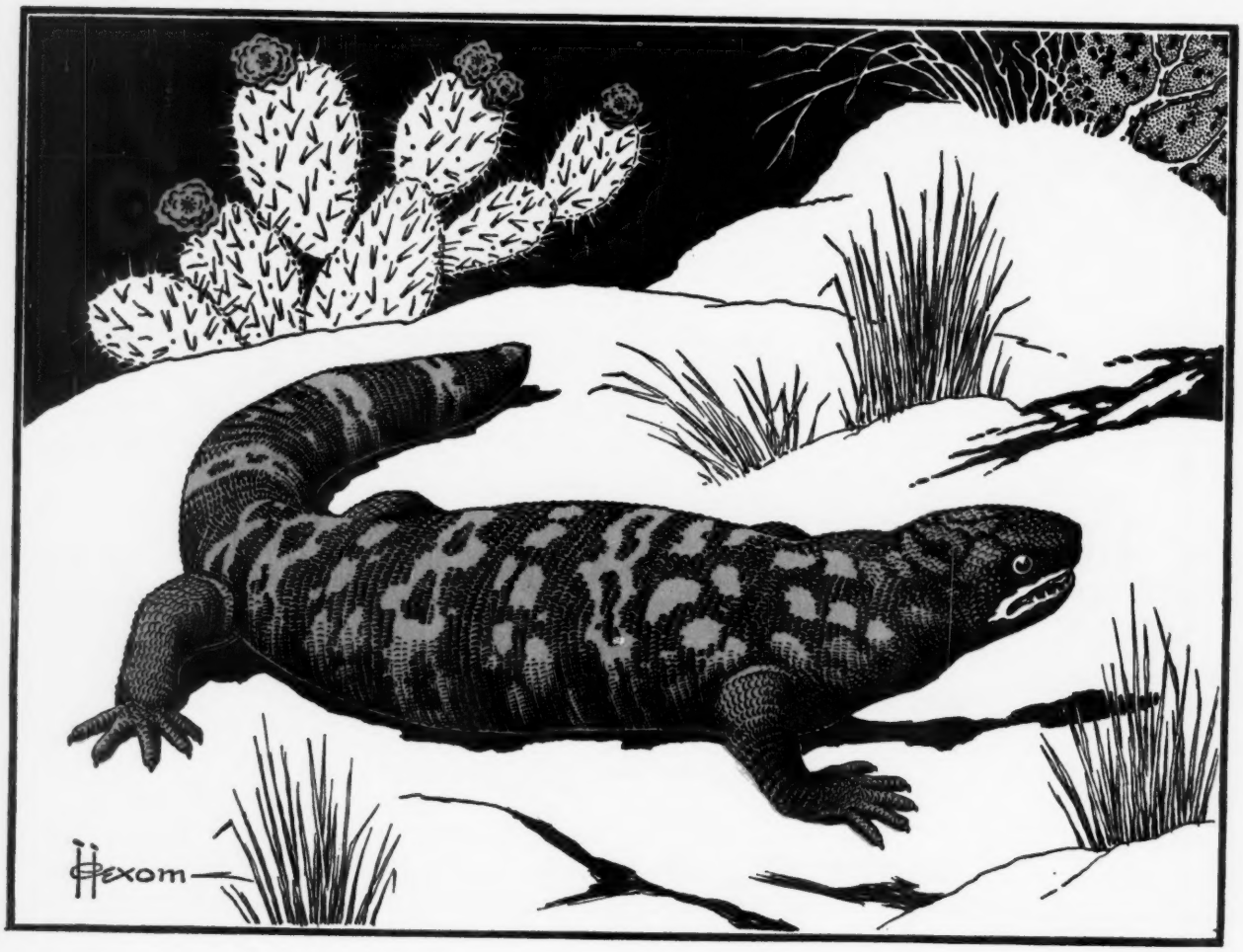

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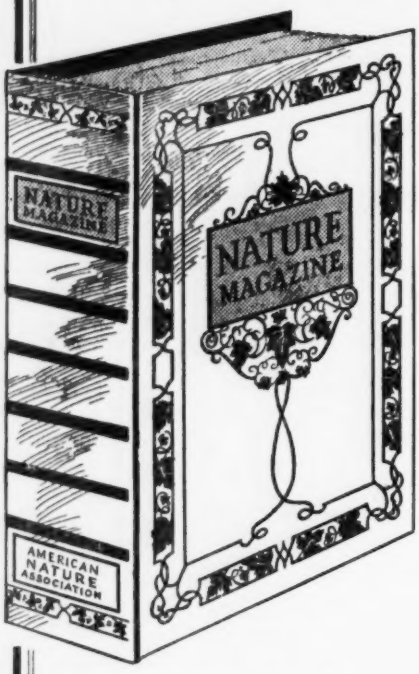

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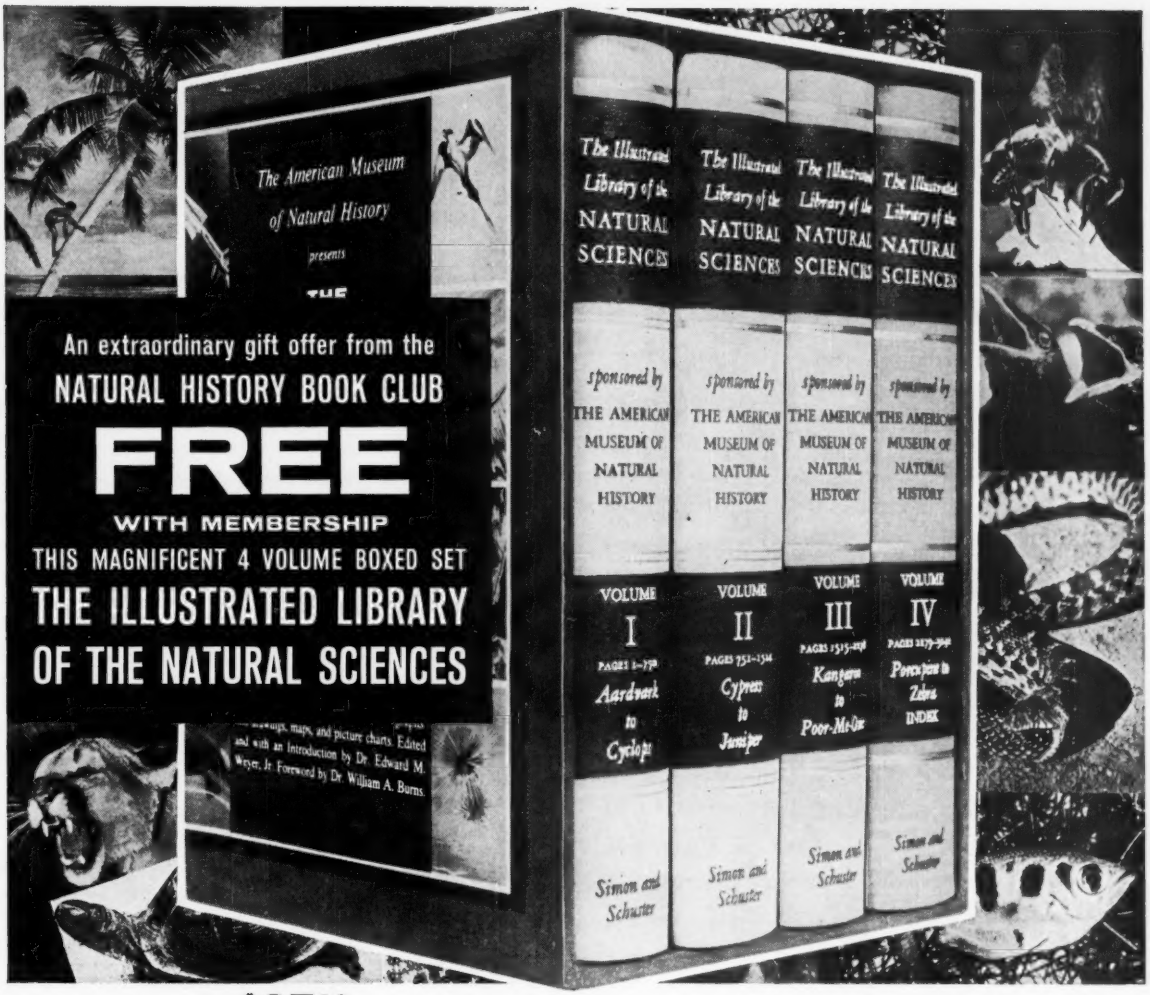

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Nature *Magazine*

MARCH, 1959 VOL. 52 NO. 3

Published by the AMERICAN NATURE ASSOCIATION to stimulate public interest in every phase of nature and the out-of-doors, and devoted to the practical conservation of the great natural resources of America

IN THIS ISSUE

SUBSCRIPTION RATE

NATURE MAGAZINE is published monthly, October to May, inclusive, bimonthly, June to September, inclusive, by the American Nature Association. Second class postage paid at Washington, D.C., and at additional mailing offices. U.S. and Canada one year, $5; foreign, $.50 extra; two years, $9; life, $100.

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Nature Magazine, past and present, is indexed in The Reader's Guide in your public library.

Reviews

Biographical Memoirs

Columbia University Press, New York. 1958. Published for the National Academy of Sciences. 458 pages. Portraits. $5.00.

Seventeen authors have contributed seventeen brief biographies of seventeen eminent scientists or physicians to Volume XXXII in this series of books of collected biography. Those included in this latest volume are Robert Grant Aitken, Oswald Theodore Avery, Ernest Brown Babcock, Francis Gano Benedict, Charles Whitman Cross, Benjamin Minge Duggar, Clarence Edward Dutton, Harold Hibbert, Claude Silbert Hudson, Wendell Mitchell Latimer, William deBerniere MacNider, Elmer Drew Merrill, Silas Weir Mitchell, Henry Norris Russell, George W. Stewart, Thomas Wayland Vaughan and John von Newmann. Bibliographies of their scientific writings are included in each case.

The Beauty of Birds

By Cyril Newberry. Garden City, N. Y. 1958. Hanover House. 103 pages. Illustrated in color and black and white. $4.95.

In a foreword the author says that this book "has but one simple purpose—to reflect some of the beauty of bird life and to present it in word and picture to those who count themselves lovers of birds." This is not a scientific or technical work. Indeed, the text is limited and concise and the captions brief. The pictures in both color and black and white are beautifully printed (in Italy) and include a number of North American species.

Astronomy

An Adventure in Astronomy. By Kenneth Heuer. New York. 1958. The Viking Press. 127 pages. Illustrated. $3.50.

Teaching A Unit in Astronomy. By J. Russell Smith. New York. 1959. Vantage Press. 149 pages. Illustrated. $2.75.

These two books seem to go hand in hand. Lecturing at the American Museum-Hayden Planetarium in New York, Mr. Heuer found that the most popular lecture was that which took the listener on a trip around the world with a view of the heavens en route. This trip the author makes in his book of astronomy adventure. His book would, indeed, be splendid supplementary reading to go with Mr. Smith's, which will be of great aid to the teacher in teaching an astronomy unit adapted for grades from one to nine. A science teacher and active amateur astronomer, Mr. Smith has done, we feel, a distinct service to many teachers who wish to teach such a unit but are fearful that they cannot safely do so. The month to month sky maps used in this book are from *Nature Magazine*, by permission.

Insect Migration

By C. B. Williams. New York. 1958. The Macmillan Company. 235 pages. Illustrated. $6.00.

Obviously this book is a pioneer work in its field, and is the only book, so far as this reviewer knows, that treats this important subject as it should be treated. Until 1915, there was only one insect, with a few vague exceptions, that was believed to migrate the way birds do, that is, south in autumn and then, after a semi-hibernating period in a warmer region, a return flight to the north in spring. Of course, this insect was our own Monarch butterfly. It was due to the discoveries of the present reviewer of this book that this conception was enlarged to include not only many species of butterflies, not hitherto considered migratory, but also dragonflies, bees, wasps, diptera and other insects. All these observations were reported in various publications, notably *Harper's*, *The Scientific Monthly*, *The American Museum Journal*, and other publications. Dr. Williams was stimulated to undertake similar studies in England, Africa, The Island of Trinidad and other parts of the world until it became his life work. Any one interested in this fascinating subject will find this book a notable achievement, and replete with interesting information.

H.J.S.

Briefly Noted

Runty and Dimpy. By Byron T. Bradley. New York. 1959. Greenwich Book Publishers. Illustrated by Armand Weston. $2.00. Two stories for youngsters, one about a black-faced lamb, the other a fawn.

Studies on the Structure and Development of Vertebrates. By Edwin S. Goodrich. Two Volumes. New York. 1959. Dover Publications. Each paperback book $2.50. Reprint of the major work of the late Edwin S. Goodrich, noted comparative anatomist.

Nature IN PRINT

By HOWARD ZAHNISER

The World of Science

NOT LONG AGO I sat down by a glowing fireplace in our living room after dinner, just about tired out after a wearying day, and started looking—merely looking—at a new book on the "conquest" of the air. It was *The Air*, by Edgar B. Schieldrop. I soon found myself carried away, as it were, with its accounts of man's early efforts to fly and the excitement of the records of achievements. The explorations and descriptions of the aircraft that today flies (in examples of which I have many times had to span the continent) were so appealing to curiosity, and the accounts of the advances "Towards the Ultimate Limit?" (as the chapter heading phrases it) were so fascinating that I found myself at the end of the volume actually refreshed, informed by text and photograph and drawing, and reminded again of the wonders about us that are accepted as part of our routine of living.

Facts for youngsters

Perhaps it was this experience, almost exhilarating in its interest, that led me some days later, when bedfast with a "cold," to pick out for reading a "Deluxe Golden Book" intended, as the publisher's press release said, to give "youngsters, age 10 and up, an exciting look-over-the-shoulder view of scientists at work in seven major fields: geology, astronomy, mathematics, physics, chemistry, biology, and engineering." This book was *The World of Science: Scientists at Work in Many Challenging Fields*, by Jane Werner Watson.

Certainly I did not continue this reading (for I read the volume through and studied its illustrations) for relaxation. The knowledge that apparently now begins reaching children at age ten is in variety and complexity in all these fields well beyond the general knowledge that most of us laymen enjoyed only a decade or so ago. Except perhaps for teachers in the schools, laymen accordingly would doubtless be not only fascinated but also amazed at the intricacies of knowledge reported here from the experts, and apparently brought within the understanding of "youngsters."

With a skill in plain statement and graphic illustration, Mrs. Watson and her associates in book making have told something of what is going on in each of the seven major fields. The author acknowledges, by name, the help of some fifty-five scientists who have furnished her information and counsel. Among them is her husband, Dean E. C. Watson, of the California Institute of Technology, who also contributes a foreword in which he explains that the book "does not attempt to give all the answers nor to cover any field completely," but does take the reader "out to the frontiers of knowledge" and provides "a fair sampling of the kinds of work awaiting young men and women in the various fields."

In a brief note about this book which I wrote for my neighbor, Dr. John K. Taylor, to include in his monthly publication distributed in and around Washington, D. C.—*The Reporter: Newsletter for Science and Math Teachers*—I described it as "like a science fair between the covers of one book." Many adults reading the volume, I dare say, will feel much as they do following their children about one of the high school (or junior high school!) science fairs, trying to comprehend the world in which their children are being educated.

Anthology of selections

George Schwartz and Philip W. Bishop have edited a two-volume work that seems to fit nicely into these circumstances of amazement at the achievements and undertakings of scientists.

Entitling their work *Moments of Discovery*, they have assembled an anthology of selections that their publishers describe as "a panoramic chronicle of twenty-five centuries of scientific progress, in the actual words and drawings of eighty-three of the great thinkers and scientific explorers of ancient and modern times." The first volume is subtitled *The Origins of Science*, the second *The Development of Modern Science*.

Linus Pauling, in a foreword, comments that "no one now can consider himself to be cultivated unless he has some knowledge of science." He expresses the hope that "many people will read this fine book." The editors, in addition to preparing their selections, have written interpretive introductions and have so arranged the whole as to help a reader's understanding. In their own preface they describe the work as "the culmination of twenty years of study."

The collection is not, as one might mistakenly surmise, limited to descriptions or testimony regarding the exciting *moments* at which studies or searchings have culminated in discovery. Rather, the anthology is of chosen portions of the writings of the philosophers and scientists, often describing the approach to discovery or expounding the concepts of the great writers collected here. I have, indeed, not yet read these volumes, nor in any way checked the work of editors, but I have read foreword, the preface, and major introduction and have been impressed by the editors' introductory comment that "it is necessary to approach these writings with more than casual attention," and have wondered if the writings might better have been called "monuments of discovery."

Four engaging volumes

In the midst of all this scientific order, to approach these writings "with more than casual attention," these experiences with the excitement and amazement of man's conquest of the air, his mastery in scientific fashion of geology, astronomy, mathematics, physics, chemistry, biology, engineering, it is indeed engaging and delightful to take in hand the four volumes of *The Illustrated Library of the Natural Sciences*.

Here is the arbitrary order of the alphabet, the changing subject matter of a magazine with articles arranged by the chance of an initial. Here is an independence, a freedom from consistency that has a satisfaction of its own. Because the various

breeds of dogs are shown in 100 drawings, it does not follow that the breeds of horses or cows must likewise be so shown. Indeed, neither "cow" nor "cattle" appears in place in this delightful library or in its index, and horses are represented by two fascinating discussions by George Gaylord Simpson on the evolution of the horse and "the story of the horse from earliest times: his place in war, peace, and sport and his claims to a lasting position as man's ally."

One might call this a whimsical encyclopedia of natural history, and any reader who is just a bit weary of always finding the same kind of information on any subject should welcome its unexpected variety—not only variety of subject matter of which any dictionary or encyclopedia could boast, but also variety of author, approach, and manner.

Nor does one sense any tyranny of entry selection. Among the A's is Audubon (John James), represented in a fascinating article by Lucy Salamanca entitled "With Audubon in the Florida Keys," and illustrated with a portrait and reproductions of photographs and three of Audubon's drawings. But among the W's there is no article on Alexander Wilson, nor on John Muir among the M's, or Burroughs among the B's. On reflection one realizes that there is no reason why there should be, and one concludes with pleasure that he has in his hands a source of almost endless delight free from apprehension of the organized compulsion of comprehensive cross-reference.

A charming combination

Indeed, what we have here is the charming combination of, or compromise between, a scrapbook and a handsomely illustrated encyclopedia, with the convenience and permanence of bound volumes. It is as though one were to make careful clippings through the years of magazine articles with their clever and brilliant arrangements and illustrations, always something different, and then have them arranged, indexed, and preserved.

In fact, apparently that is what Edward M. Weyer as editor, and Frederick L. Hahn as art director, have done in preparing *The Illustrated Library of the Natural Sciences*. From that excellent and fascinating magazine *Natural History* and from other publications of the American Museum of Natural History they have chosen these four volumes, these more than 3000 pages, of natural history articles, also with more than 3000 illustrations. Their achievement in informative informality is remarkable, and their resulting "library" will enhance any shelf, interest any reader, and give relaxation to anyone afflicted with too much. It would have been a much better choice for the fireside that weary evening not long ago.

Moments of Discovery: The Origins of Science. Edited by George Schwartz and Philip W. Bishop. New York: Basic Books, Inc. 1958. xvii + xi + 1005 pp. (6¼ by 9 3/8 in.), in 2 volumes, boxed, with foreword by Linus Pauling, 88 selections from writers on science and mathematics, 53 text reproductions of drawings, graphs, or other illustrations accompanying the selected writings, and index. $15.

The Air. By Edgar B. Schieldrop. New York: Philosophical Library. 1958. 256 pp. (6 1/8 by 9¼ in.), with forewords by J. T. C. Moore-Brabazon (Lord Brabazon of Tara), 147 photographs (1 in color), 28 drawings, charts, etc., and index, $12 (sic).

The Illustrated Library of the Natural Sciences. Edited by Edward M. Weyer, Jr., with Frederick L. Hahn as art director. New York: Simon and Schuster. 1958. xvii + 3042 pp. (6 by 9 in.), in 4 volumes, boxed, with foreword by William A. Burns, articles by 172 contributors (including 7 junior collaborators), end paper drawings, "more than 3,000 photographs, line drawings, maps, and picture charts," and index. $25.

The World of Science: Scientists at Work in Many Challenging Fields. By Jane Werner Watson. New York: Simon and Schuster. 1958. 216 pp. (8¼ by 11 3/8 in.), with foreword by E. C. Watson, 16 photographs in black and white and 217 in color, 124 charts, drawings, and maps, front end paper diagram showing "Order of Magnitude," back end paper diagram showing "Range of Electro magnetic Waves," and index. $4.95.

Briefly Noted

The Atom and the Energy Revolution. By Norman Lansdell. New York. 1959. Philosophical Library. 200 pages. Illustrated. $6.00. A work for the general reader interested in the social and political implications of the new scientific breakthrough.

Reviews

A Field Guide to Trees and Shrubs

By George A. Petrides. Boston. 1958. Houghton Mifflin Co. 431 pages. Illustrated. $3.95.

This is the latest addition to the splendid Peterson Field Guide Series, and it presents a new and practical approach to the identification of trees, shrubs and vines of northeastern and central North America. Illustrations have been supplied jointly by author and editor and are designed to make possible the quick identification of any one of the 645 species covered. The author has avoided difficult terminology to the end that the amateur may find his way about easily in this book. The author, veteran field naturalist, has had this book in preparation for a long time and it is a happy circumstance now to be able to welcome it.

1001 Questions Answered about Birds

By Allan and Helen Cruickshank. New York. 1958. Dodd, Mead and Company. 291 pages. Illustrated. $5.00.

This husband-wife team of ornithologists, bird photographers, writers and lecturers has been asked innumerable questions about birds. These queries have covered a wide range of ornithological curiosity, and the idea of collecting the most-asked, most interesting and most important questions into a book of this sort is an excellent one. It is, in fact, one in a series that covers or that will cover questions asked about the weather, astronomy, trees, the seashore and the mineral kingdom. A good index makes possible easy reference to the information provided, although it is also interesting just to browse at random through the book.

The Rise and Fall of Ye District School in Plimouth Plantation

By William Gould Vinal (Cap'n Bill). Norwell, Mass. 1958. A Vinehall Publication. 144 pages. Illustrated. $3.75.

While this interesting book may seem to be a departure for that noted Nature educator, Cap'n Bill Vinal, reading of its nostalgic and educational-history pages proves it pertinent to current problems in education. It is done, in part, as a tribute to the adventure in education undertaken by the Plymouth Colony and, as such, is by no means confined in significance by its seeming geographical limitations. The author urges that it is wise to gain a perspective of three centuries of educational progress in "Plimouth Plantations," and he proves his point. Not the least fascinating in this book are a number of pages of reproductions of old documents representative of the teaching processes of the time. R.W.W.

The Orphan Raccoons

By Mary Louise Edwards. Ann Arbor, Michigan. 1958. Barton House. 77 pages. Illustrated. $2.50.

This is the true story of life with two baby raccoons, found orphaned when they were just large enough to fit into a cupped hand. The pair made charming and individualistic pets, ingenious and full of amusing tricks. Although reared by human foster parents they returned to life in the wild and to raise their own families, or at least the female, "Sweetie Pie" did, and brought her youngsters back for a visit and handouts. Mrs. Edwards has told her story simply and without too great sentimentality, often the bane of animal pet stories. This is a most attractive little book for a gift, although we hope that her next book will be printed by a process that will show off pictures to somewhat better advantage.

Briefly Noted

Romance in the Garden. By John H. Tobe. Toronto, Canada. 1958. George J. McLeod, Ltd. 368 pages. $5.00. While this is a book about gardening, it also includes humor, philosophy, anecdote, folklore and plant adventure.

Animals that Help Us. By Carroll Lane Fenton and Herminie B. Kitchen. New York. 1959. The John Day Co. 128 pages. Illustrated by Dr. Fenton. $3.50. The story of living things that help man, and a companion volume to *Plants that Feed Us.*

Collecting, Preserving and Studying Insects. By Harold Oldroyd. New York. 1958. The Macmillan Co. 327 pages. Illustrated. $5.00. The title is descriptive of the contents of this book by a British entomologist.

Spring Flowers of the Lower Columbia Valley. By Clara Chapman Hill. Seattle. 1958. University of Washington Press. 164 pages. Illustrated by Mary Comber Miles. $3.00. A regional handbook and guide to the flowers of an area rich in botanical interest.

OUR MARCH AUTHORS

Ruth M. Rasey

Lloyd Parratt

Elizabeth Ingles is dean of girls at Roosevelt High School in Fresno, California, a writer of Nature-interest articles, and a student of animal behavior. With her mammalogist husband and her young son, she has traveled extensively in the Central American Republics and Mexico. . .Ruth M. Rasey, now a resident of North Tonawanda, New York, is a sixth-generation Vermonter whose ancestors were among the first settlers of Old Bennington, Vermont. A free-lance poet and article writer, Miss Rasey makes a specialty of stories of the way of life "on the old homestead." Currently she is president of the Western New York Branch of the National League of American Pen Women . . .Lloyd Parratt has been a seasonal ranger-naturalist at Glacier National Park since 1946, having been attracted into the service through attendance at the Yosemite Field School of Natural History. Mr. Parratt has been active in natural science and conservation teaching in Ohio, Arizona and California; in 1957, he received a merit conservation award from the California Conservation Council for his work with youth in conservation. He also is chairman of the biological science department at Chaffey College. . .Lyn Harrington, with her husband, Richard, compose a well-known and widely-traveled team of Canadian article and book writers and photographers. Mrs. Harrington was born at Sault Ste. Marie, Ontario. . . Howard J. Shannon, life-long resident of New York's Long Island, lives at Jamaica, where he has been for many years a student of the geology and plant, insect and bird life of this area, specializing in the observation of insect migration. . .Jane V. Sheppard, of Memphis, Tennessee, started her wage-earning career as a laboratory technician in a hospital, then switched to free-lance writing after discovering that full-time jobs and housekeeping are not compatible. . .Harriet Burkhart is a bird and plant enthusiast, article writer, photographer and active traveler who, when she is "at home," lives in Union City, Pennsylvania. . .Alexander B. Adams, vice-president of a Pittsburgh, Pennsylvania, bank and an editorial writer for the Hartford, Connecticut, *Courant* has variously been newspaper reporter, F.B.I. agent, army lieutenant and active businessman and conservation worker, as well as free-lance writer. He lives at Bradfordwoods, Pennsylvania.

Contents noted BY THE EDITOR

SCORE ANOTHER VICTORY FOR PUBLIC OPINION in averting the threat to Porcupine Mountains State Park in Michigan. Application for a permit to carry on copper mining in this outstanding area brought a rumble of protest that grew into a roar, both within the State of Michigan and without its borders. The State's outdoor organizations, conservationists and many individuals registered their opposition to granting the permit. National conservation groups, including the American Nature Association, added their voices. Protection of irreplaceable asset was pitted against an exploitation of dubious justification. Hearings were held and resulted in the recommendation of Gerald E. Eddy, Director of the Department of Conservation, that the application be denied. This was a courageous decision in the light of political pressures. Whereupon the application of the mining company was withdrawn. There still lurks the possibility that some action by the Legislature may be sought, but the conservation view is now strong and ready to meet any such move.

SCORE ANOTHER VICTORY IN OHIO, where the highway planners had drawn on a map the route for a 300-foot, dual lane, limited access highway right through 1700 acres of reservations and park in the southwest part of the State. Despoiled would have been Glen Helen, a 1000-acre outdoor laboratory and Nature preserve owned and operated by Antioch College. Also ruined would have been John Bryan State Park, one of the State's most remarkable areas, as well as the site of five youth camps serving Boy and Girl Scouts, 4H Clubs, public schools and a State orphan's home. Once again the rumble of protest grew to a roar, which Ohio's Governor, William C. O'Neill, heard and heeded. The highway department was ordered to remap its route and the threat was averted. However, this instance points up the serious problems being created by the mushroom growth of "urban sprawl." We are going to have many more such fights on our hands if we are to preserve some open spaces for tomorrow and many tomorrows. But we have ample proof that public opinion, with the right on its side, can prevail.

BIRD LOVERS SHOULD AVOID ITALY, writes one such, struck by the nauseating evidence of that country's massive trapping and eating of small song and insect-eating birds. Visiting the Isle of Capri, he saw assorted bunches of larks, thrushes, finches, nightingales, robins and other species offered as tidbits for the frying pan. Elsewhere in Italy it was the same. The birds are eaten —bones, entrails and all—for the bits of meat found on them. Movie-goers who saw *Gigi* will recall the actress who played the title role crunching on the bones of a small bird as part of her training in the social graces. That picture was laid more than a half-century ago, but the practice still prevails in Italy, and in Spain and Belgium. The birds are netted and trapped in great numbers during the spring and fall migratory seasons. Some trappers place under the nets small wooden cages in which there are deliberately blinded birds that serve as lures. Protests to the government, even to the Pope, have brought no action. In one small town it is traditional to have a three-day celebration of the harvest, and for this observance more than 100,000 songbirds are eaten, roasted over hot coal fires, laid between buns, and sold at stands and in eating houses. Such medieval practices, added to the hideously billboarded miles of the main highways, are competing with the attractions of Rome, Florence and Venice. As people of taste and decency return from Italy with such reports, more and more of their friends are likely to leave that country off their list of places to visit.

OUR ARTICLE ON COMPOUND 1080, which is the registered trade-mark of Tull Chemical Co., in the January issue brought immediate and widespread response from our readers. With the exception of those living in areas where these "controls" are employed, correspondents were shocked and disgusted by these poison programs. People living in those areas *know* what the effect has been on wildlife populations. One reader wrote that a dozen years ago the members of the family had moved to Oregon because they wanted to be closer to the wild and to wildlife. Today, however, thanks to poison, trapping and other predatory animal control programs, wildlife is rarely seen. Others have added more testimony and more evidence to the extensive documentation that supports our article. All congratulated Mrs. Smelser, the author, for having written it, and *Nature Magazine* for having the "courage" to print the article. We join in congratulation to the author, but publishing her article was not a matter of courage. We have long been convinced, and have often said in these pages, that this whole business of "predator control" is an unsavory mess deriving its perpetuation from the bureaucratic edifice it has built and the moneys that can be dispensed in its name. If the government really wishes to exercise some economy, here is an excellent place to start. R.W.W.

PHOTOGRAPH BY THE AUTHOR

NATURE AT THREE

On tilted toes he tries to reach
The secret in the tree,
Perhaps a pixie's hiding there —
Or maybe just a bee!

At every turn there's something new
For a little man of three,
The brand new world of Nature holds
So much for him to see!

Bettye Breeser

Whistlers at Timberline

By ELIZABETH INGLES

Photographs by Lloyd G. Ingles

The yellow-bellied marmot, or rockchuck, makes its home in rock slides close to mountain meadows. The first individual to sight a predator warns his fellows with a clear, piercing whistle.

LIFE IS rugged at timberline in California's Sierra Nevada. The growing season is short and the battle with the elements constant. In the summer, granite rocks glare and glitter in the intense rays of the sun that burn through an atmosphere nearly devoid of dust or smoke. Here the forest is scattered. The gnarled and weather-beaten trunks of junipers bear the scars of long ages of struggle with wind, rain, sleet, snow and lightning. A few western white pines grow in more protected spots where they are able to reach great size without becoming malformed, although often a longitudinal slash cut almost to the heartwood shows where lightning struck the trunk without felling the tree. On certain exposed granite slopes white-bark pines, twisted and misshapen like the junipers, show the effect of years of buffeting by unrelenting storms. Yellow, lime, and brown crustose lichens find niches on the mottled granite rocks, slowly spreading and at last softening the outlines of the boulders. In early summer magenta Sierra primroses push their roots into soil pockets at the bases of huge rocks while purple sky pilots, scarlet gilia, flaming red zauscheneria, and pale blue columbine struggle to live in the thin granitic soil.

At timberline in the Sierra Nevada, the gnarled and weather-beaten trunks of junipers bear the scars of incessant struggle with the elements, while a few western white pines grow in protected places.

At this altitude—about 9500 feet, depending on the slope, latitude, and other factors—the alpine meadows are less lush than those found at lower elevations in the red fir-lodgepole pine community. Stunted willows, hazelnut, creek dogwood, and red elderberry follow a meandering stream. The grass in the meadow is short, and in low, spongy spots near the creek early summer finds drifts of wild peony and swamp marigold. Here one may hear the deep-throated song of the Yosemite toad, and watch as one of these small enamoured suitors blows his throat out in an enormous bubble that nearly obscures his head as he makes love to his more corpulent female friend. He sits in icy water fresh from nearby snow banks, completely oblivious to its temperature. Later these amphibians leave the stream to hop about in the meadow in search of insects that they capture with a sudden flip of their long, sticky tongues. If the sun beats

Belding ground squirrels live in burrows in the high-altitude meadows, and members of a colony communicate with high-pitched, staccato whistles.

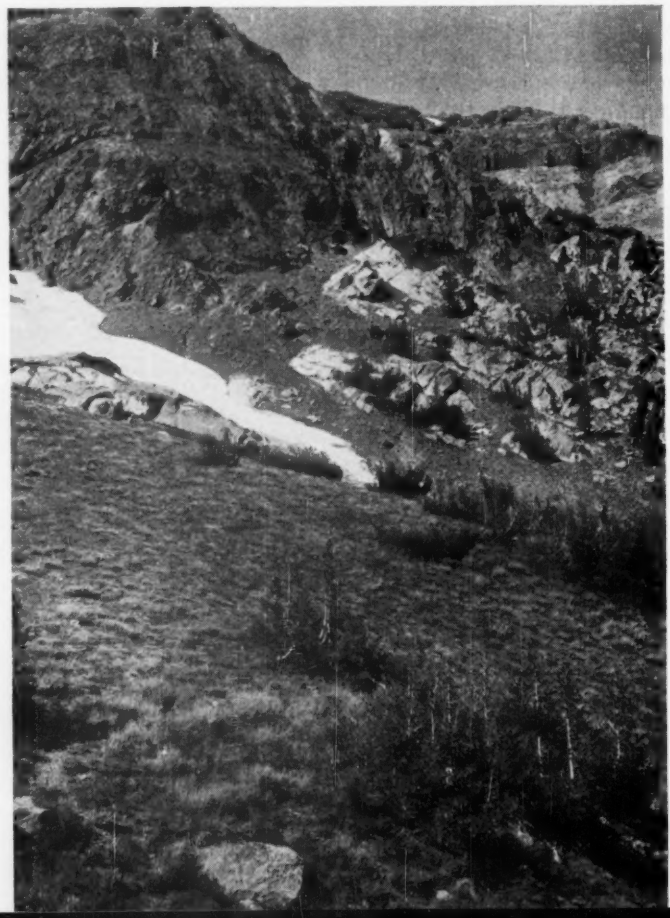
down too warmly, causing the moisture to evaporate uncomfortably from their skins, they find shelter in abandoned holes of squirrels or in the open mouth of a montane pocket gopher burrow.

Such an alpine meadow close to timberline often is the home of a Belding ground squirrel colony. These little grayish-brown squirrels spend an active summer galloping over the grass to the mouths of their burrows, rolling together in play close to the nest hole, or standing erect like statues as they listen for alien sounds. Sometimes a lone coyote leaves the pine cover at the edge of the meadow and creeps stealthily toward the squirrel colony. If the little Belding squirrels are vigilant, the foe will be discovered. With a high-pitched, staccato whistle the sentry warns its fellows of danger. By successive whistles the message of alarm is passed from hole to hole as each animal in the colony notifies its relatives of an enemy before retreating into the safety of its burrow. If the coyote occasionally goes hungry here, it may look for a fat marmot asleep in the sun on a granite rock, or even surprise a Sierra grouse scratching in the duff beneath a western white pine.

The Belding squirrels can not afford to relax their guard for an instant. If they outwit the coyote, they may fall to other hungry predators. The goshawk may shoot like a bullet from the top of a nearby pine, swooping low over the colony with talons spread for the kill, pale yellow eyes agleam as it hunts food for its brood of homely youngsters in the nest high on the branch of a stately pine. Near a Belding colony large elliptical holes may sometimes betray the presence of another predator, the badger. These big, flat-looking carnivores have strong feet, well adapted for digging out the burrow of a ground squirrel. The long-tailed weasel, which sometimes lives beneath a windfall or under the roots of a great pine, would like nothing better than to serve a fat little squirrel to its nestful of hungry young.

Weasels are not at all uncommon even during the daytime in the Sierra. They are extremely curious and, if an observer will remain quiet, they may check their first frightened dash and return to study the intruder with their bright, beady little eyes. Weasels are great rodent eaters. In spite of their reputation for killing birds and destroying their nests, these mammals much prefer a dinner of fat ground squirrel or meadow mouse. In proof of this, I recall one long-tailed weasel that raised a litter in a nest beneath a wooden floor of an old building. Its lithe form often bounded gracefully through the grass carrying a fat meadow mouse to its four ravenous young, while less than twenty feet distant a russet-backed thrush sat motionless on her nest in a cascara bush scarcely a foot above the ground, watching with her dark expressionless eyes. Even after the eggs hatched and the young weasels wandered from their den they often stood on their hind legs to sniff at the edge of the nest, but never touched the fledglings. Not that they would be at all hesitant about enjoying a bird dinner if they were hungry, but here their bellies were stuffed with young, tender meadow mice.

Weasels are gluttonous eaters, and are extremely quick as they squirm through rock piles or brush thickets



Near timberline in the Sierra Nevada the forest is scattered. Low white-bark pines, short grasses, and other hardy flowering plants may grow at high altitudes, depending on the slope, latitude, and other conditions.

in search of rodents, rabbits, or birds to satisfy their ever-demanding appetites. Although slim, they have great strength for their size. In the high Sierra the ermine, a small cousin of the long-tailed weasel, was once observed to run a non-stop, three-hundred-yard dash to its den beneath the spreading roots of a Sierra juniper, carrying in its mouth a large white-footed mouse nearly as heavy as itself.

Sometimes the excited chirps of white-crowned sparrows or harsh screams of Clark nutcrackers warn the Belding squirrels of the approach of a weasel. If on an exposed granite boulder. Like the Belding squirrels, the first marmot to see an enemy warns its fellows with a clear, piercing whistle. Sometimes a marmot "sounds off" far up a ridge, then another and another takes up the cry; but the warning comes too late, and a majestic golden eagle sails away with a fat little marmot dangling from its talons.

The yellow-bellied marmot, a short-tailed, short-legged member of the squirrel family, and about the size of a house cat, is sometimes called "rockchuck," because it lives in rock slides close to mountain meadows.

In the granite talus above the tree line the pika, a tiny relative of the rabbit, works breathlessly throughout the short summer months, gathering and storing its winter supplies.

The pika spreads its "hay" to cure in the intense rays of the sun. When dry, the crop is stored for winter use in a convenient spot under the rock slide.

the wily predator loses its dinner in this manner, there are other less wary rodents to satisfy its needs. For, in the more moist parts of the meadow beside the creek, montane meadow mice scuttle along their trails in the short grass, and in the dryer spots mountain pocket gophers, with tiny eyes and whiskery faces, often rest in the sun half-way out of their tunnels.

If the Belding squirrels are the whistlers of the meadow, the yellow-bellied marmot holds the same reputation in the rock slides at the edge of the forest. These large, groundhog-like rodents often bask in the sun

Wearing a coat of grizzled yellowish-brown fur sprinkled with white above and orange-yellow below, the rodent looks something like a little, fat, pot-bellied old man as it lumbers heavily across the meadow, or dives for cover beneath a boulder.

Although the marmots seem to spend considerable time just lying in the sun, they are hard workers. In these high mountains the summers are short and the rodents must eat as much as possible and become fat, so that they will have stored-up calories on which to live during the long winter of hibernation. The layer of fat also helps to keep the mammals warm when temperatures are low and cold winds blow into their nest burrows. Although big and clumsy in appearance, a frightened marmot can gallop to its den with surprising grace and speed.

Meadows near the rock slide provide food for the marmot. Here, on warm days, a female and her family of six to eight roly-poly young gorge on grasses and other herbs in preparation for the long winter. Or they lie basking in the sun on smooth boulders, ever on the watch for coyotes, foxes, or wolverines that might try to invade their rocky citadel. Finally the days shorten and the sun beats less warmly on the rock slide. Clark nutcrackers quarrel noisily over tidbits, or dive at each other through the quaking aspens whose gold and crimson leaves tremble and shake in the fall breeze. Nights grow colder, and at last the marmots are seen no

Weasels are not uncommon even during the daytime in the Sierra Nevada. They are extremely curious, and if the observer remains quiet the mammals may check their first frightened dash and return to inspect the intruder.

more. They have retired to their nests in the "basements" of their rocky castles to sleep, while winter winds blow and a blanket of white falls over their homes in the boulders.

Another rock dweller is the pika. In a granite talus above the trees, this tiny relative of the rabbit works breathlessly throughout the short summer months. Its task is tremendous, its size small, and the summer short. The little mammal neither hibernates nor migrates to a kinder climate, and if it is to live through the long winter it must gather and store large quantities of herbage. In the talus slopes above the limits of the forest, the winters are harsh indeed, and even the summers may bring rain, snow, drying winds, or beating sun. In such a climate, tiny hanging meadows at the edge of the talus, watered by brooks fed by melting snows, supply the food for the little mammal. Even the plants growing in the meadow must be opportunists, rushing the growing process from seed to plant and from flower to seed. In such a climate, no living thing expends energy beyond its essential needs. Thus the willow here reaches a height of less than two inches, and trusts its posterity to the seeds of a single catkin. Tiny gentians produce a deep-throated, purple flower that ultimately withers and produces seeds that ripen and fall into crevices in the rock, while the mother plant dries up and dies. Here, too, Sierra shooting stars, low-growing alpine shrubs, short grasses, and sedges struggle to reproduce.

In such a meadow the pika works, busily cutting the meager herbage, carrying mouthfuls of it to the rock slide near its nest, and spreading it out beneath an overhanging rock to cure. It is said that should a sudden storm bring a summer rain, the little hay-maker interrupts its cutting and storing of winter food to carry its drying crop to a shelter under the rock slide. Then, the rain over, it will spread the hay again in the sun until it is thoroughly dried before storing it permanently in its nest beneath the talus.

Often a peculiar, ventriloquistic call echoes over the rock slide. The nasal *eenk, eenk* sound seems to come first from one direction, then from another. Loud and penetrating, the noise may be heard long before the noise-maker—none other than the little unrabbit-like rabbit, the pika—is discovered. Such a voice from this tiny ball of fur seems incredible, and especially from a rabbit, representative of a mammal group that is notoriously silent except when expressing pain. But the nasal whistle of the pika is characteristic of the rock slide. Perhaps the call is a warning to its fellows of danger in the form of a hawk or a weasel in search of prey, or perhaps it is the voice of a mammal seeking a mate.

Life above ground is impossible for the pika during the long winter. During these months, the little lagomorph stays beneath the rock slide, living on the "hay" put away during the growing season. Here a hungry marten or weasel may take its toll, but for the most part the pika is safe from both climate and its animal foes.

Life is indeed harsh at timberline in the Sierra Nevada, and much living must be crowded into a short time on these rugged, windswept slopes. Here the little whistlers—the Belding squirrels galloping over the mountain meadow, the pot-bellied marmots basking in the sun on their rock slides at the edge of the forest, and the tiny, breathless pika in the talus—have met individually the problems of their environment. Danger, for them, is ever-present. A sharp-taloned goshawk or golden eagle may hurtle down from the clear blue sky, or a fox, weasel, or mountain coyote may snuff out life as the mammals reach for a tender bit of herbage, or rest for an instant beside the waters of the snow-fed brook. This is Nature's scheme, a plan that must be maintained forever to keep the little whistlers as strong as the gnarled and weather-beaten junipers, symbolic of the fight for life at timberline.

SPIDER

A spider needs such small encouragement,
Anything that's still is heaven sent;
Immobile branches, dreaming flower heads,
All perfect for his first, long anchor threads,
And he would robe me head to toe in lace,
If he could trust the stillness in my face.

Bessie F. Collins

The great white birch trees that once populated these acres of a mountain farm in southwestern Vermont have vanished, but the woodland is still well populated by the tall, white-barked younger growth. The American Indians who once camped in this hill country looked upon the white birch as the dispenser of good gifts.

Champion White Birch Grove

By RUTH M. RASEY

Photographs by courtesy of the Vermont Forest and Farmland Foundation

"Our great white benefactors." That was what grandfather's father, in the early eighteen-hundreds, more than once called the big canoe birches on his mountain farm in southwestern Vermont.

During Forest Festival Week, in 1957, it was announced that the national champion white birch among American "big trees" had been found in that same area, which is now known as the Vermont Forest and Farmland Foundation. Because it was nominated by the late George W. Merck, the man who established the Foundation and who was its president and chief financial support, it was named the George W. Merck Birch.

As I read the announcement of its acceptance as champion by the American Forestry Association, I could only wonder if this canoe birch might not be the last survivor of those "great white benefactors" of more than a century ago. Estimated to be possibly two hundred years old, it bears the scars of time and weather.

At breast height, its fungus-invaded trunk measures nine feet, two inches in circumference. Although winter gale or summer lightning have torn away its top, the old giant still rears its scraggly head sixty-five feet above the dark leaf mold of the forest floor. Its thick, horizontal branches, reaching out among crowding neighbors, attain a maximum spread of forty-three feet, and many of its limbs, in conflict with the winds and snows of many seasons, are likewise jagged at their tips.

Gone now are seed-mates and numerous successor generations of birches, but these woodland acres are still well populated by the tall, white-barked younger growth. This grove has supplied many a decade of the hill-man's need.

Great-uncle Peter used to tell tales of the long ago, and how wandering Indians utilized the birches of this fertile mountain slope when they pitched their tepees here before the white man came. They learned early to look upon the gleaming birches as the givers of good gifts.

Broad, pliant sheets of bark, tough as rawhide, the squaws ripped from gigantic trunks. Sometimes they soaked these for greater pliability in the woodland brook, then bent and poled them for shelter. When they moved on, they often took their roll of bark with them

to use again for a tepee. From their mothers they had learned that this powdery, white hide, with which the Great Spirit had dressed His most beautiful tree, would protect His red children from sun and frost and evil insect and the rain. Knowing nothing of cell, air space, or corky insulation, instinct still led these primitives to the white birch for their transportation, shelter, and other necessities.

Along the banks of the rushing stream, the braves once or twice carefully felled previously reserved big trees, from which they stripped the strong, white bark in one piece. This they "toasted" to make it flatten, and placed it in a form of stakes. Inside it they set their framework of cedar strips, steamed and bent to the proper shape. Over this skeleton of their cedar-ribbed canoe, they sewed the bark with long fibers from the split roots of spruce and cedar, and they calked the seams with gummy pitch from the boughs of the nearby Balm-of-Gilead, or balsam fir, trees. Bearing as many as a dozen red men at once along the valley waterway still known as Indian River, the craft was yet so light in weight that two young boys could carry it at portage.

Dipper and bucket, basket and dish the squaws and children likewise fashioned from smaller pieces of the bark, sometimes combining two layers and turning the golden-brown side outward to prevent its peeling with repeated use.

In every season's weather, bark and timber from this white friend also provided the nomad's fire, his indispensable defense against hungry wolf and panther, chilling wind and zero cold. A spark from his briskly rubbed stones' friction never failed to find ready tinder in the delicate white shreds peeled from trunk and bough. To this the greenest twig and branch gave quick fuel for the cooking fire. The Indian took not only bark and timber for canoe and lodge and household need, but he also drew sustenance from the shining trunks.

Legend has it that one cold March morning in the sixteen-thirties an Iroquois chief hacked with his tomahawk into one of these white birches to get a block of bark for his squaw to patch an arrow hole in their wigwam roof. When she returned to the tree for more bark, later that sunny day, she found the "boxing" from her husband's cut filled with a most refreshing, crystal-clear and delicious wonder-water. How much better, she thought, this would be than the usual snow water, in which to boil the venison for her husband's evening meal.

Scooping the sparkling liquid out into a birch-bark cup, laced with strawberry vine, she accumulated enough during the day to half fill the wooden trough in which she did her cooking. Into the birch sap, then, went the chunk of deer meat and the shimmering hot stones from her wigwam fire. Replenishing the hot rocks at intervals, she produced the most flavorful venison stew that her chief had ever eaten. With appreciative grunts, he demanded more; and so it was that sugar, instead of salt, became the red man's favorite seasoning for his meat. The succeeding days and years, the story runs, found many an Indian striking a sharp-edged implement into various trees of the forest, but only the canoe birch and one kind of maple yielded the sought-for wonder-water, and then only during the Moon of Melting Snow, the legend tells us.

This great white birch of southwestern Vermont may be the last survivor of the "great white benefactors" of former times, and was nominated by the late George W. Merck as the national champion white birch among American "big trees."

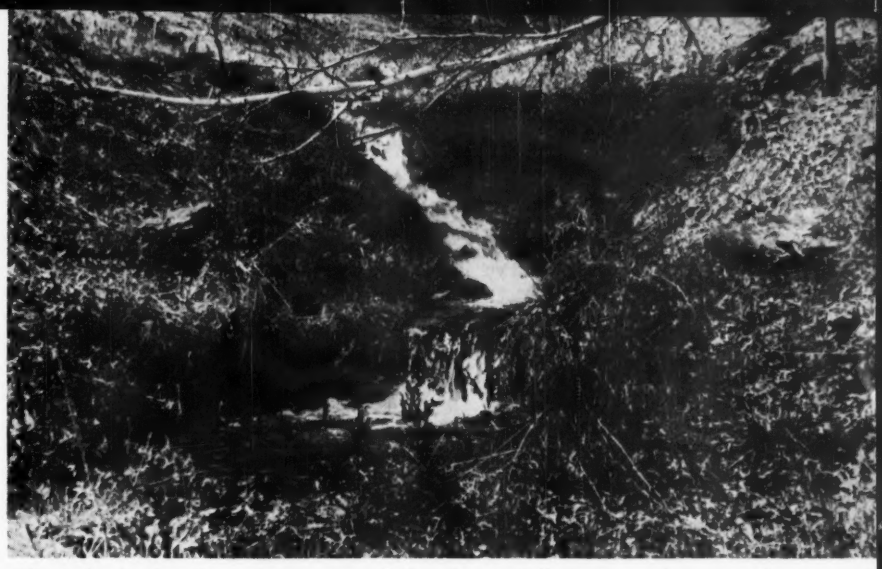
At first, those red men knew its use only for boiling their meat and corn. Then, by the prolonged cooling of a haunch of particularly tough bear meat one day, they discovered a miracle syrup that hardened as it cooled, and could be kept indefinitely.

When the Indians shared their discovery with their new white brothers to the south and east, the newcomers tried another method of securing the sap. Instead of boxing the tree, the White Man gashed the trunk with his hatchet, inserted a thin chip or sliver of wood, and caught the drip in a birch-bark cup! Thus, according to legend, today's maple sugar industry is derived from the gift of the early white birch grove.

Another story of great-uncle Peter's told of the red man's use of this tree for medicine. The patient squaw would gather wide strips of inner bark from trunk after trunk each spring or early summer. Boiling this tender by means of hot stones and rain water in the wooden trough at her wigwam's opening, she then ground the mass to a soft paste between flat rocks. The juice she carefully scooped up, again in her birch-bark cup. When need arose, her toil-worn brown fingers applied the healing lotion to cuts, burns and sores on

afflicted papoose, chief or brave.

Great-grandfather, too, had faith in the health-giving properties of his birches. A strong tea, brewed from tender twigs boiled in spring water until the liquid was dark amber, was one of his favorite tonics. He often drank a generous cupful before eating his fried potato, corned beef, and dried-apple-pie breakfast, to keep him, as he said, "in condition." He and his family frequently chewed the inner bark, too, the delicate mint flavor serving to freshen the mouth and soothe the canker.



Along the banks of a rushing stream, Indian braves felled previously reserved white birches, from which they stripped the strong bark in a single sheet. The strips were soaked in the brook and formed on poles for shelters. When the Indians moved on, they rolled the bark and took it with them.

Both great-grandfather and the red man before him found that the inner bark of this bountiful provider could be dried and used for food in lean times. When the corn supply ran low, they ground the starchy substance and mixed it with their morning mush. During the frost-every-month-of-the-year of 1816, generally known as "Eighteen Hundred and Froze to Death," vast quantities of the bark were milled to supplement great-grandfather's meager grain resources for his starving sheep and cattle.

When his father built his first home on this hill in 1787, he too, had found the canoe birches an asset. He spread thick sheets of their weather-proof bark along his roof before laying his hand-rived shingles. Many a time his sons lined their sheep-skin moccasins and leather boots with insoles of the protective bark, also, as insurance against the chilblains that first bitter Vermont winter.

That same early spring, when Daniel Shay was fleeing from Massachusetts following his famous rebellion against government taxation, to seek refuge with fellow-officers of the recent Revolution in the nearby town of Sandgate, it was reported that he out-foxed his pursuers by hiding in the underbrush of this big birch grove. Here the tall trees were, indeed, his benefactors. From their bounty he erected a bark roof against the elements, kindled a fire to warm and dry his fugitive body, and over quickly-glowing coals roasted what game he could snare.

Many of the giant trees in the first stand of this grove were felled for charcoal for the blacksmith shop in the village. Here, in the early eighteen hundreds, Preserved Wright, the smith, spent long hours each winter chopping both the big trees and the smaller to thin the grove for better growth, as well as to secure the hottest fuel then available for his forge.

When spring came, the smith dug his coal-pit, a shallow space twelve or fourteen feet square. Setting his two-and three-foot logs in a tepee position in the center, he built the longer ones up all around this conical core. When his huge pile filled the pit area, he covered the whole birch stack with sod and dirt to keep out air. He left a tiny opening at the front, and through this, by means of his "Long Tom" musket and some bits of tow, he fired the center logs. Preserved had brought with him food and his blanket for this four-day-and-four-night vigil while his logs smoldered to charcoal. His spade stood ever ready to supply an extra scoop of dirt if needed. Air penetrating the pile could send his entire winter's work up in a stack of flame. But all went well, and the slow heat finally charred his logs to a harvest of fuel, supplying his forge with the needed heat for shoeing many a horse and ox, for shaping crane and pot-hook, hasp and hinge for the early settlers' dwellings.

Great-great-uncle Obediah also drew from this grove the wood for his "dish turnery" business. Smooth, pale-yellow trenchers and plates, "sassers" and noggins, piggin, "losset" and "skeel"—the last two being shallow containers to hold milk for the cream to rise—all came by the dozens from his lathe to supply the pioneer table before silver, pewter and china made their appearance.

Great-grandmother's dye-pot was sometimes replenished with dry leaves or bark from these birches. A yellowish-tan for her son's and husband's homespun breeches came from the leaves; rose-tan for her daughters' woolen petticoats from the bark. Many an hour she spent in gathering, crushing, and boiling her dye-stuff in water from the pasture spring, her rain-barrel, or the snowbank at her door. Soft soap, made from waste fats and lye from the fireplace ashes—often contributed by the birches—she used to "set" those dyes.

Her ash container in her back yard was, itself, a birch stump barrel. Two and a half feet in diameter, it had been hollowed by slow fire and her husband's ax and adze. Punctured at the bottom, it was set on a strong

cask, which received the lye drained from the barrel when accumulated ashes were drenched with water from the farmyard well. This lye had to be strong enough to support an egg or a potato so that a part the size of a ninepence would show. Six bushels of ashes had to be leached in the outdoor tub to supply a barrel of the clean, jelly-like soap for the early American household. Twenty-four pounds of grease also were required, to be boiled with that amount of lye in the big black caldron, slung by trammels over the backyard fire on soap-making day.

My earliest memory of that birch grove stems from a family expedition to the nearby berry lot one July day. That hot afternoon, Dad lined our canvas shoes with birch-bark insoles. To our surprise, our small toes found relief from the heat of the burning rocks that jutted up in the field. And when we slyly tried the shallow pools at the edge of the brook, our soles were strangely waterproof.

Dad showed us how to make drinking cups by cutting circles of bark, six inches or so in diameter, from a fallen birch. Each of these we creased into quarters, and clipped the "wings" into the shape of a cone with the split end of a stiff two-inch stub of a willow twig. Of course we made frequent trips to the berry lot spring with our new cups.

A basket, too, to hold the duskiest, sweetest fruit we had ever found he fashioned from a sheet of bark, shed by one of the older trees, and which we found at the edge of the woods. After lacing the nine-by-eighteen-inch golden brown and white strip into a cylinder, with strands of wild grapevine, he similarly laced in a six-inch round of bark for the bottom.

Each year our mother made a dozen or more cornucopias for candy and nuts to hang on our Christmas tree from the bark she peeled off the birch chunks for our winter fires. Stitching these into sturdy containers with bits of red and green yarn left from her knitting, she made a strong loop of yarn to hang each satiny white horn-of-plenty on the fragrant green boughs. To each she also attached tiny sprays of pine, wee cones and scarlet barberries. We loved our cornucopias!

On one of our earliest family pilgrimages through this mountain woodland we came upon what has now been named the "Champion Birch." Our *Midas Tree*, we called it that October day. Its hoard of golden leaves, through which the sunlight sifted, gave a burnished crown to the monarch's buffeted head and wealth to his silvery pockets. Gathering a handful of the fallen "coins," we laughingly called them our lucky pieces.

Neighbored close by many a younger canoe birch, mingling with beech and ash, maple, elm and hornbeam, the venerable white birch today looks down upon a woodland block, specially designated for managed cutting operations for research and demonstration. Profits from this area will be used by the trustees of The Vermont Forest and Farmland Foundation for a scholarship for local youth, to point out the values of forestry.

BALTIMORE ORIOLE

Black and orange, debonair,
He hangs a castle in the air.
Ray Romin

PHOTOGRAPH BY J. J. HEATLEY

"Fasten your safety belts, please." With an eight-foot wingspread and a landing speed of about twenty miles per hour, this swan gets the green light for an into-the-wind landing on Mill Pond at Stony Brook, Long Island.

From "The Narrows," the calm waters of St. Mary Lake in Glacier National Park reflect the mountains over which runs the Continental Divide. The small islet in the foreground is Wild Goose Island.

Photographs by the Author unless otherwise credited.

Close to the shore of St. Mary Lake is the Sun Camp Ranger Station, where the author and his family observed nesting goshawks and banded their young.

A ranger and his family study

Glacier's Nesting Goshawks

By LLOYD PARRATT

I was stationed as a ranger-naturalist with my family in the Sun Camp Ranger Station, which dates back to the time when Glacier National Park could be explored only by trail. The spacious cabin of hewn logs is nestled among the Douglas fir, Engelmann spruce, and alpine fir at an elevation of forty-five hundred feet. Some fine old black cottonwood trees fringed emerald-green St. Mary Lake, framing it and the mountain peaks that rise abruptly on the opposite shore.

One day in mid-July we spotted a large hawk darting around among the tree-tops near our cabin. At intervals, the hawk uttered a series of staccato cries of *kak, kak, kak*. The short, rounded wings and long tail indicated one of the accipiters. The hawk seemed larger than the golden-eye ducks that we had been looking for at the time. We had often enjoyed the antics of golden-eye ducks as they made a game of flying from the lake to the large black cottonwoods in front of the cabin.

After considerable maneuvering to get a good look at the hawk in company with Harry Robinson, the park naturalist, Harry said, "I believe it's a goshawk." We noted the rather dark upper parts and numerous horizontal markings on the under parts. The broad conspicuous stripe over the eye extending to the back of the head, along with the above-mentioned markings, made it certain that it was the western goshawk, *Astur atricapillus striatulus*.

The goshawk is the largest of the accipiters or bird hawks; but like the other accipiters, it is difficult to observe because of its habit of keeping to cover and its proclivity for turning and dodging among the branches and undergrowth of the forest.

We soon discovered that the cause of the goshawk's staccato cries—this bird is mostly silent except when its nesting area is invaded—was its nest, some sixty feet high in an Engelmann spruce. The tree was only fifty feet from our cabin, the Sun Camp Ranger Station, and it offered us an opportunity to study this bird. According to Bent, the nest of the goshawk is usually in a conifer at heights from twenty-five to seventy-five feet, and is a bulky affair usually two feet in diameter and one to two feet deep. The same authority states that the number of eggs is three to four, the incubation period is twenty-eight days, and that the young remain in the nest for twenty-eight days.

Monty, my eleven-year-old son, climbed up to make close-up observations and measurements of the nest. It measured three feet long, two and one-half feet wide,

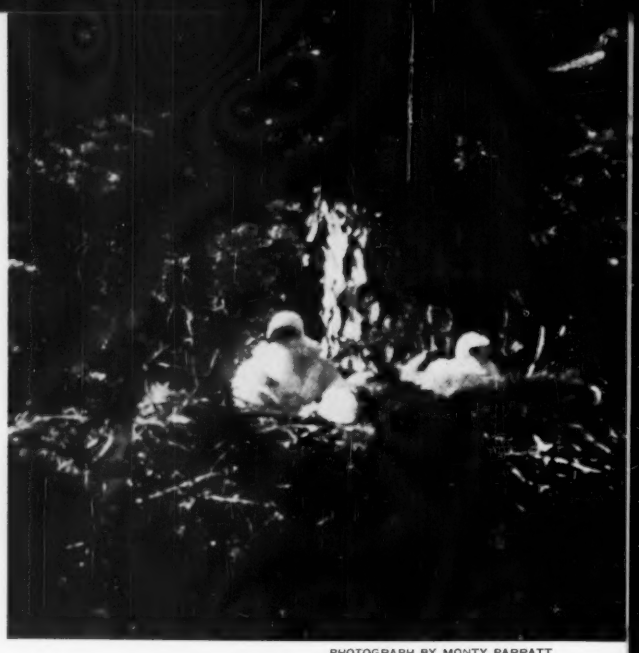
and about two feet deep, and it was composed of sticks and green alpine fir branchlets, rather loosely put together. It was lined with fir foliage and some feathers. There was only a slight depression on the top, which was almost flat. Placed in the fork of the spruce tree at sixty feet, it was fairly well hidden. The nesting spruce tree was on the bank of Baring Creek, which emerges from a canyon and drops down as Baring Falls, 200 yards from the nest tree.

When Monty climbed up to the nest he wore a tin hat, and was forced to defend himself with flailing arms as the adult goshawks dived at him with great power and speed. The attack of this bird is swift and furious, and its drive is powerful enough to break a fishing pole, also according to Bent. The goshawk has been reported actually to strike a man walking along a trail. Monty found four young goshawks in the nest with downy coats of white, and they were still quite small.

For two months observation and study of the goshawks became a family project, averaging an hour or more daily—and several hours on week-ends—for each member of our family of five. Monty, strong and agile, did all of the climbing and observing from above while the rest of us watched from the ground. Monty also took pictures by boldly climbing up a Douglas fir, located twenty-five feet from the nest site in the Engelmann spruce. An adult goshawk would always give its alarm note, fly from tree to tree, and then swoop down at the young man several times. Picture-taking was difficult, in view of such defense tactics on the part of the goshawks, and shinnying up a tree sixty feet high, with a diameter of two feet at the base—and with hardly a branch for a foothold—is a real challenge.

Monty, eleven-year-old son of the author, starts a sixty-foot climb up an Engelmann spruce to take a picture of the goshawk nest.

Early in August we decided the young birds were old enough to band, and that they might fly from the nest if we waited much longer. We outfitted Monty with a long rope and a gunnysack tied to his belt, with the idea of placing the young birds in the sack and bringing them down. As Monty came up to the nest the chicks hopped out and fluttered down in all directions, to light here and there in smaller trees, hanging mostly upside down with small branches clutched firmly in their talons. However, one bird was strong enough to fly parallel to another tree-top. There was considerable scrambling about as we gradually retrieved three of the young goshawks, but could not get the one that was in the top of a tall black cottonwood.



PHOTOGRAPH BY MONTY PARRATT

In a nest composed of sticks and green alpine fir branchlets were four young goshawks with downy white coats.

The young birds snapped their beaks menacingly, but did not bite. We took pictures of them and banded them, and noticed that the young birds tried to stay out of the hot sun and that they gathered around Monty for protection. Monty then took the birds in the burlap sack and climbed up to return them safely to the nest. Excitement mounted as an adult bird returned to the nest and swooped viciously at our son. This time Monty had to ward off the bird by striking at it with his tin hat. We all breathed a sigh of relief as Monty safely reached the ground.

The chick that flew to the top of another tree eventually returned to perch above and near the nest—but it never returned to the nest, although the adults fed it nearby.

The next day an adult goshawk shadowed us as we walked along the trail through the forest from the cabin. Flying from dead tree to dead tree, the bird uttered strange screams of a plaintive quality, sounding like *kew kew kew*, or perhaps *kee-a-ah*. We were puzzled to know the significance of such behavior.

The western goshawk is largely of northern distribution, living in the boreal forests. Its food is mainly birds, with a scattering of small mammals. Their predation is usually unseen as they seize their prey and vanish quickly.

Goshawks provide natural control for other bird life as well as for chipmunks and squirrels. Hawks and other predators are part of the natural balance of our wildlife population and the accipiter hawks eliminate many birds and mammals that otherwise would meet death from starvation or disease. Through such control,

Nature provides a balance that prevents birds and other animals from becoming too abundant, so it would seem just as important for hawks to eliminate part of the bird population as it is for hawks and owls to eliminate part of the rodent population.

It has been said that the young of the goshawk are fed only once daily, but we observed the young being fed several times a day. The young also exercised daily by stretching and flapping their wings, as we noticed after we had banded them. Since the juvenal plumage shows when they are half grown, we estimated the age of the birds when banded as more than two weeks, one being smaller than the rest. They obtain full juvenal plumage at three to four weeks, except for the down on the under parts and neck, and they leave the nest at about this time. The breast is clove-brown, edged with pinkish-cinnamon streaks. It appeared that three of the young were in full juvenal plumage by mid-August; but the runt remained concealed in the nest. The juvenal plumage is retained for about a year.

We found it difficult to see what animals were brought to the young in and around the nest. They tore the animal flesh into chunks with their beaks while holding the prey with their talons. When food was brought in by an adult, the young could be heard peeping with a rather songbird-like quality. They were fed oftener the third week; or perhaps feeding was more evident, since the birds now fed singly or two at a time, either in the nest or on a branch near the nest. In the St. Mary Lake area, goshawks eat small mammals like the abundant chipmunks and white-footed mice, and small birds of all kinds. Swallows are too agile for these predators, as are also birds of the open. The goshawk prefers dark, forested areas.

During the second week, when all four young were in the nest, we had observed them fighting over food, and heard much peeping like baby chicks. At this time the birds arranged themselves around the outside portions of the nest. They stretched their wings in the nest.

During the third week they took many short practice flights. They pulled off meat with their bills and then sat on the edge of the nest to complete the swallowing of large chunks of meat. They regurgitated the hair and feathers of animals in pellets. The adults were kept busy feeding individual young birds, who always greeted the adult with sweet chirps totally out of keeping with their large size and ferocious appearance.

All four young birds were active at this time, and took small flights out on branches and higher up on other branches. The wings were noticeably larger, and the birds practiced maneuvering their long tails. Two birds sometimes playfully touched bills. They no longer fought over food, and ate one at a time, pulling meat apart and swallowing at the same time. The youngsters acted like clumsy adolescents at this stage. The down around the legs and under parts had the appearance of "pantaloons."

After the young goshawks had been studied for two months, they were brought down from their nest to be photographed and banded. Then they were taken back to their nest in a burlap bag.

On the morning of August 14, one baby bird remained on the nest. Another was perched in a large cottonwood across the creek. Both were calling with a loud, clear "peeping" call as they did when food was brought in by the adult. This call is a happy, baby-like call in contrast to the urgent piercing call of hunger, which sounds like *whee whee*. One young goshawk had a chipmunk clutched in its talons.

The nest had been slowly falling apart under the impact of the vigorous eating activities of the goshawks. By August 14, it was about two-thirds gone, and only the runt remained on the nest. However, the other young birds stayed close to the nest-tree. By the morning of August 15, the nest had fallen completely apart and we found sections of it on the ground. The young birds were perched on and near the nest-tree.

After this, the adult goshawks were feeding the young

Against a background of spruce-fir forest, one of the young goshawks is seen perching on the chimney of the ranger cabin. The bird's juvenal plumage will be retained for about a year, and is distinguished by breast feathers that are clove-brown, edged with pinkish-cinnamon streaks.

by coming in rapidly to the tree and then dropping the dead prey, usually chipmunks. Birds were not as available, having completed their nesting season. This feeding occurred at low elevations among trees, and the young had to catch the falling prey. They often fought over it. This appeared to be a way of teaching the young how to catch their prey. The runt of the brood remained at the nest site and called continually for food.

On August 19, the runt of the nest kept flying down to the roof of the cabin. At about noon it was hanging upside down from a branch. Then it fell to the ground with its eyes closed. In a few minutes it was dead, apparently from starvation. It also seemed to have a defective leg. The weakest and smallest of the group had been eliminated.

For the next week we heard the birds calling somewhere in the forest, but they no longer returned to the nest site. The young birds had full juvenal plumage now, and seemed as large as the adults. They would soon catch their own prey.

We did not hear the birds again, and two months of interesting experience with goshawks came to an end.

The Fight for Life

By WELDON F. HEALD

Photograph by the Author

MAJOR John Wesley Powell, who was an able geologist and ethnologist, made a strong case in his book, *Truth and Error*, that choice, which is a form of consciousness, is a property of all matter, from the smallest particle to the universe itself. Certainly there are many strange phenomena in Nature that are difficult to explain in any other way.

For example, the illustrated alligator juniper, growing high in Mexico's Sierra Madre Occidental near the gigantic gorge of the Barranca del Cobre, seems to show a quasi-conscious adaptability to changed conditions, and a tenacity of life that is as remarkable in its way as that of any animal.

For some years the tree apparently had grown normally. Then, little by little, torrential summer rains enlarged a nearby gully, sweeping the soil away from around the juniper and leaving it hanging in mid-air, four feet from the bank. But three roots continued to hold it, and the tap-root took over as a new trunk. It now supports the tree from the gully floor, twelve feet below. This root-trunk now is nearly a foot in diameter and furnishes the only example I have ever seen of a tree that has added height from the bottom as well as from the top. Meanwhile, the other three roots have grown, and still function as true roots nearly half-way up the tree.

The setting for this grim arboreal battle for survival also illustrates the serious problem of erosion in the Mexican Sierra. Both humans and trees are adaptable, each in their own ways, but neither can survive long in a land stripped of its top-soil. Comprehensive conservation measures are needed here, as in many parts of the United States, before it is too late.

This alligator juniper in Mexico's Sierra Madre Occidental range has survived severe gully erosion by converting its tap-root into a new trunk twelve feet high.

MILKY WAY

The diamond Dipper tilted, spilled
This stream of dancing light,
This rivulet of nebulae
Across parched plains of night.

Ethel Jacobson

PHOTOGRAPHS BY RICHARD HARRINGTON

The largest boulder mosaic found by the author was the figure of a snake, some 300 feet long and shaped like the letter "S." The snake's head is a triangular boulder, somewhat flattened in appearance, seen at upper left in the photograph. Some of the stones in the figure have been disturbed.

There is mystery in the

Boulder Mosaics of the West

By LYN HARRINGTON

From Iowa north to Manitoba and west as far as southern Alberta and Montana the Plains Indians left traces of their occupation in the form of cairns, mounds, pictured rocks and figures outlined in glacial boulders. These last perhaps might be called "boulder mosaics," for lack of a better name.

Many of the boulder mosaics are simple circles that usually have been attributed to the Indian custom of pinning down the hems of their skin tepees. In some areas they simply pegged them down, but sometimes they anchored them with stones of various sizes, just as a modern camper might. Many such "tepee rings" fifteen to twenty feet in diameter have been found on the prairies, and quite naturally they were noted by early explorers, who confidently classified them as tepee rings.

Although the tepee rings seem easy to explain at first glance, their real meaning is not entirely self-evident. Probably they served a variety of purposes. Some of the circles are too small for a tepee, being only five feet in diameter. Some may have been campfire stones, although all do not show evidences of fire. Large rings up to ninety feet across are several times the size of any known tepee. "It seems quite probable," says the *North Dakota Museum Review*, somewhat cautiously, "that they may have had a religious or ceremonial significance."

The rings appear in many places, and occasionally archeologists have burrowed beneath them. Chris Vickers, archeologist of the Manitoba Historical Society, noted many in the vicinity of the Assiniboine River, most of them badly disturbed. Other archeological work had proved the occupation of Siouan Assiniboines at the site between 1768 and 1793, and Mr. Vickers carefully excavated beneath one ring and unearthed the bundle burial of a horse's bones.

"Squares, rectangles, circles and other geometric figures occur, including wheels," writes Dr. Douglas Leechman, of the National Museum in Ottawa. "More remarkable still are those which outline the figures of men, turtles or snakes. In many cases they are on top of a knoll, or on the edge of a coulee, sites from which a large expanse of prairie can be seen. As a rule, tipi rings

Near a granite outcrop similar to that in the photograph on the preceding page, the author and her husband discovered a small "snake" about eight feet long, nose to nose with a "turtle." The turtle is about the same length as the snake, but is outlined in flatter stones, all of which are lichen-covered.

are to be found nearby, marking an ancient camp site."

John Maclean, a Canadian historian, has described a group of cairns on the summit of a limestone hill in the Moose Mountains of Saskatchewan. "The central one was surrounded by a heart-shaped figure of stones, from which six rows of stones radiated, to terminate in small cairns," said Mr. Maclean.

A number of figures have been found in North Dakota, including half a dozen turtles. One excellent figure, fifteen feet in length, was found in the eighteen-eighties. Sketches were made of the stones, and their positions were carefully noted according to compass directions. Then, in 1909, the boulders were transferred to the Capitol grounds in Bismarck; but, unfortunately, the figure has long since disappeared. The best and largest turtle, twenty-five feet long and outlined with double rows of stones, lies near Price, North Dakota.

While these figures occur mostly on the prairie, they also have been discovered in wooded areas. A great many have been found in the Whiteshell Forest Reserve, near the eastern border of Manitoba. Snakes and turtles seem to be the main theme. Some lie close to the road, while others are in more remote sections of the Whiteshell, and there have been several new locations discovered during the progress of road construction. Unfortunately some of the more accessible figures have been disturbed by vandals, or by survey crews that did not realize their potential archeological significance.

Archeologists and historians are not altogether in agreement either as to the meaning of the boulder mosaics, or as to their origin. They have been variously attributed to the Crees, the Ojibways, the Sioux and the Mandan group. There are numerous literary references to the importance of both turtle and snake in the life of the Ojibway and Chippewa Indians.

For instance, Alexander Henry, the elder, noticed that among the guardian spirits of the Ojibways the first place was occupied by the tortoise or turtle. Henry had good reason to observe the Ojibway veneration of the rattlesnake, for he very nearly became one of its sacrificial offerings. A footnote observes: "The reverence paid by the Ojibways to the rattlesnake as grandfather and king of the snakes is evidently a survival of serpent worship common to all undeveloped races. All the Indian tribes preserved some form of it, and amongst the Dakotas and Shawanoes, the same word was used for snake and spirit."

So the figures of the Whiteshell continue to be an alluring mystery. There is decided lack of archeological evidence to link them with any tribe, for few of the customary bones and fragments of tools have been found. The local Indians are not particularly helpful, either. They attribute the mosaics simply "to those who have gone away." And there the matter rests.

YELLOW LICHEN

Hammered gold in patterned grace
Makes my wall a treasured place.
Eddie W. Wilson

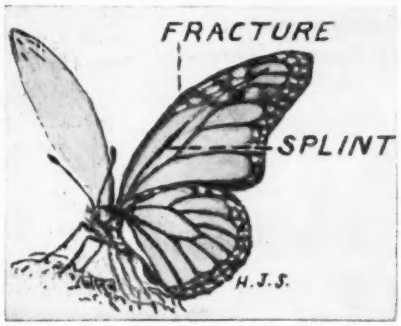
Surgery for a Monarch

By HOWARD J. SHANNON

Illustration by the Author

DURING THE month of September I have always watched for the migrant Monarch butterflies that pass over my yard in central Long Island, New York, on their way to Florida. September of 1958 was no exception; but an incident occurred during that year's migration that led to an experiment in butterfly surgery. This is an account of what happened on that occasion.

A friend had been gathering grapes from my grapevine, and had left the basket in my living room. The next morning, when he arrived to transfer the grapes to a smaller basket, a Monarch butterfly, which evidently had been among the grapes the day before and had been overlooked, emerged and fluttered to the floor. It had a badly bent vein on its left wing, and obviously would never fly again unless some human aid could be supplied.



A successful experiment in butterfly-wing surgery was performed by the author with the aid of a broom-straw and some mucilage, the "splint" being applied as shown in the above illustration.

I was particularly interested in this butterfly. Ever since 1910, studies of the Monarch butterfly have engrossed my attention and have been recorded in various publications. *Nature Magazine*, in its May, 1954, number printed the result of one such study—the almost incredible struggle of the Monarch with violent autumnal winds on its migratory flight—under title of *A Noble Breed—The Migrant Butterflies*. This, then, was an accident in which I felt a most particular concern!

Some means must be provided to strengthen and secure that wing. So a broom-straw, somewhat less than the length of the wing, was secured. Then this splint was dipped in a thin glue, or mucilage, and applied to the wing structure. The wing was strengthened by this support, and rendered straight and true. Now I was confronted by a long, boresome half-hour of pressure on the splint to allow the mucilage time enough to dry and harden.

Fortunately, a ring of the door-bell revealed a salesman soliciting orders for milk delivery. Fortunately, too, he was so persistent and loquacious that the necessary half-hour passed quickly! By that time the adhesive had hardened. The wing was now strong and firm.

When I placed the butterfly on the porch floor, it immediately began to expand and close its glorious wings. Evidently my surgery had been a success!

Soon it fluttered to the nearby path, where it continued to exercise its newly acquired strength with such vigorous confidence that it augured well for any further efforts it might make. Now some extraordinary behavior was manifested. The butterfly suddenly began to vibrate its wings with such spasmodic violence that it almost seemed as if the insect would shake itself apart. This behavior was followed by a period of repose. Then the violent movement would start again and continue for some time.

All through the afternoon I looked out, from time to time, to see how my patient was progressing. And there in the path it reposed, with the September sunlight glorifying its golden-orange and crimson wings until it seemed more beautiful than any other Monarch I had ever beheld.

Perhaps there was a reason for this. Never before had I been privileged to personally aid this regal traveller in its journey; never before had it even occurred to me that I, an earth-bound mortal, could aid the accomplishment of continental flight.

Occasionally the butterfly would move about in the path and again engage in those violent shudderings, as if it would test, ever more vigorously, the efficiency of its wings. Even after darkness had fallen I could still see its colorful form in the path. On the following morning, when I arose early to see how the butterfly had fared during the night, it was nowhere to be seen! I searched everywhere. I could only wish it Godspeed on its undaunted and, I hoped, undefeated way.

HUMMINGBIRD

Specifications (very terse):
Many speeds forward, one reverse.
Ray Romine

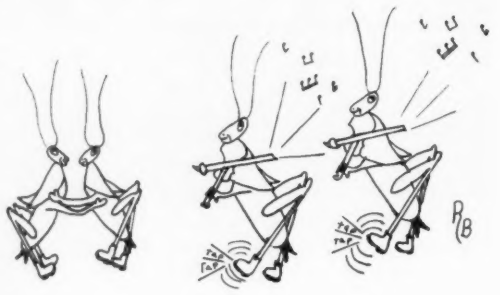
Life with the Insects

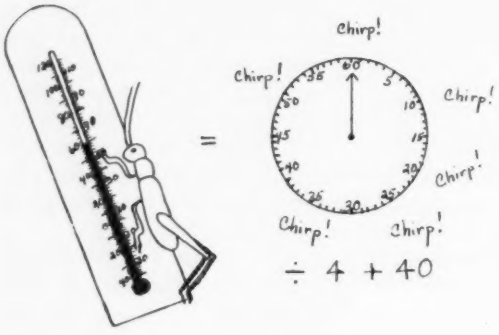
Illustrated by the Authors

WHEN biology instructor Sister Mary Dolores, O.S.F., of St. Francis High School at Little Falls, Minnesota, wanted to provide a motivation for research reading, she requested each of her students to give an oral report on an insect. Many of the students gave talks of such merit that Sister Mary Dolores decided to have each produce a cartoon-type illustration, suggesting some fact or event of insect life, to supplement the talk. The youthful cartoonists busied themselves, and Nature Magazine *takes pleasure in passing along to its readers several of these illustrated facts of insect life.*

CRICKETS have a very peculiar way of making their noise. They do not rub together their legs as do some insects. Instead they make use of their wings for this purpose. The males are the privileged concert makers of the species. The females act duly flattered as they tune in on the male chorus.

ROSELYN BERINGER, Grade 10



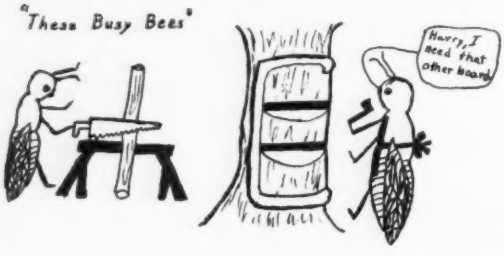


STRANGE as it seems there is such a thing as a "Crickethermometer." Yes, the cricket can give you the temperature on a summer day. Here is the formula: count the number of chirps per minute, divide by 4 and add 40. This will be equal to the temperature. Hint: The hotter the weather the more chirps per minute.

ANN PIEKARSKI, Grade 10

ODDLY enough, there are insects called carpenter-bees. The female lives alone in the trunk of a tree and makes cells which look like little shelves, one above the other. In the bottom cells she mixes a paste of sawdust and honey in which she lays her eggs. She closes the cell with a cement-like substance. Like a good mother, she leaves ample food to supply her young until they are ready to transform into pupae.

LAUREL NAGEL, Grade 10



THE harvester ant makes a circular clearing around its mound. It allows only one species of grass to grow. The ripe seeds are carefully harvested by the ant and stored in the chambers of the mound. If the seeds spoil they are brought out of the mound and thrown away.

MARY B. STENGLEIN, Grade 10

Natural History Changes

By E. LAURENCE PALMER

Illustration of L. H. Bailey by Frances McKittrick. All other illustrations by Buena Valentine.

This is the one-hundredth of NATURE MAGAZINE'S *special educational inserts.*

Ernest Thompson Seton

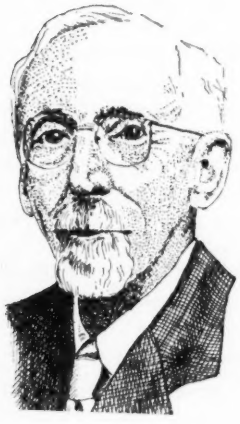
SLIGHTLY MORE than thirty-six years ago, in January, 1923, *Nature Magazine* began publication. This issue of the magazine represents the end of twenty years of publication of these special inserts every other month, not counting a short time during World War II when the series was temporarily suspended. It seems appropriate that the one-hundredth insert should be somewhat concerned with the changes that have taken place during the generation, or so, since the periodical began in 1923. This does not imply that the magazine has been responsible for all the desirable changes that have taken place, but it has been contemporary with them. Thus it seems worthwhile to call attention to some of the changes both in our understanding and in the recognized importance of natural history during that time. It is exciting, stimulating and challenging to review these past years, although now and then discouraging.

Frank M. Chapman

Albert Hazen Wright

From many possible approaches to this subject, we have chosen first to deal with changes in the academic disciplines on which any interpretation of natural history must be based. We have selected nine of these, which, although they are not necessarily mutually exclusive, seem to have entity and to have had emphasis. Among these are such fields as mammalogy, ornithology, ecology and so on. We have elected to focus attention on at least one individual who, during the period with which we are dealing, has made representative contributions. It is not our idea to say that these are the sole, or even the best selections. Indeed, if readers question the selections, and privately or publicly propose and defend other choices, our desire to stimulate interest will have succeeded. Indeed, we hope that our choices will be debated.

Frank Lutz



As a second category, we suggest some of the important devices and skills that have developed and which are useful in increasing appreciation of the disciplines presented. Among these are skills in the use of machines, microscopes, test tubes and statistical machines, such as cameras; skills of a manual nature such as are possessed by artists; literary skills, and other skills, including those that get people, young and old, to do things that help us appreciate natural history and develop its power for good.

Adults frequently find personal satisfaction in the accomplishments of their offspring, or of their pupils. Similarly, natural history is entitled to pride in the records of the special disciplines that have evolved from it. Much as youth does not always recognize the gifts it received from more mature associates, so modern specialties in the natural history field do not always reflect their debt to the parent, natural history.

Almost on the very day that *Nature Magazine* began publication, in 1923, Henry Morton Wheeler wrote his celebrated *The Dry-Rot of Our Academic Biology*. The

Liberty Hyde Bailey

Peter Paul Kellogg

paper was presented on December 29, 1922, and published in *Science* on January 19, 1923. It makes real sense today, and should be reread periodically by every biologist, amateur or professional. Wheeler called attention to the mythical Antaeus who periodically gained strength by contact with Mother Earth, and declared that much biology suffered from its failure to study Nature and because of too much study of books. Wheeler quoted Nietzsche to the effect that: "In all institutions which are not ventilated by a keen draught of public criticism, an innocent corruption grows up like a toadstool." He might have quoted, as example, much that has since been advanced as valid by some science educators. Wheeler also quotes William James to the effect that "the natural enemy of any subject is the professor thereof." He says that "the power of the professor is revealed not so much by the things he teaches, as by the things he fails or refuses to teach." Certainly, the teaching of natural history has reflected this philosophy in its handling of birth control, evolution, vivisection, and other locally controversial aspects of the subject. Surely a sensible treatment of these subjects calls for judgment, courage and leadership, not only in the classroom but in the programs recommended by teacher-

Louis Agassiz Fuertes

Arthur Newton Pack

trainers. Fortunately, or unfortunately, as you may see it, our new discoveries in the natural history field are so important and so interesting that if one wishes he can avoid consideration of controversial matters. Some of us think, however, that Wheeler's philosophy, expressed in 1923, should still be required study in 1959. It would be interesting to know how many natural history teachers in training have ever been exposed to Wheeler's." Dry-Rot,"[1] to Sharp's "Five Days and an Education,"[2] to the introduction in Philip Gosse's "Naturalist's Sojourn in Jamaica."[3] It is interesting to consider the exposure to the ridiculous "science" of the average elementary school text, and some high school texts, published during the past few decades, and to the long string of approved studies, which, for thirty years, have accepted as valid the ridiculous Dvorak "general science test."[4] Some of these references should stimulate approval and some disapproval, but they all require the habit of going back to the original source so common with scientists and so uncommon with many educators. While science has moved ahead and gained deserved public approval by remembering Antaeus, science education has frequently stood still or lost ground by forgetting it. Where do we go from here?

W. C. Allee

It is absurd to assume that natural history has progressed only in the eighteen areas here discussed, and equally presumptuous to suggest that any of these are or can be adequately covered in the space available. Thus it might be well to suggest a few developments that have assumed great significance in recent years.

The story of pollution now holds public attention, where thirty-five years ago it caused little worry. Now we realize that pollution is a general danger. Not only must we avoid polluting streams from which we wish to drink, or in which we wish to swim, but we must think about the dangers of polluting great lakes, or even the sea, with wastes associated with the manufacture of nuclear bombs. The soils on which we raise crops we know may be polluted by the accumulation of chemicals used to control plant enemies in the plant or animal

1. Wheeler, H. M., "The Dry-Rot of Our Academic Biology" in Foibles of Insects and Men, pp. 189-194, 1928, Alfred Knopf, New York City.
2. Sharp, D. L., "Five Days and an Education," Cornell Rural School Leaflet, September, 1950.
3. Gosse, P. H., "What is Natural History?", "A Naturalist's Sojourn In Jamaica," Longman, Brown, Green and Longmans, London, England.
4. Dvorak, A., "Dvorak General Science Scales," Public School Publishing Company, Bloomington, Illinois, 1924. Read also page 115, Curtis, F. D. Investigations of Teaching of Science, 1926, P. Blakiston's Son and Co., Philadelphia.

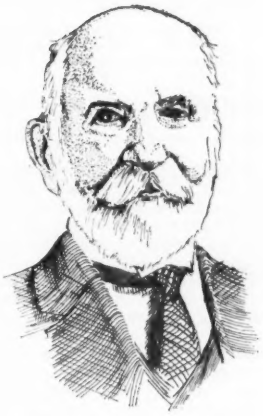
fields, and by uncontrolled erosion that may make useful areas useless. We have become somewhat aware of the dangers of pollution of the air, particularly over large cities, and the effect this may have on the health and prosperity of great numbers of people. We have even stepped over into the social sciences and learned to realize the dangers of polluting the thinking of people by the application of psychology in brain washing, in advancing subversion and in other areas.

Predation has taken on a new significance during the years. Where we formerly seemed to be opposed to any sort of predation among wild things, we now recognize that it is generally a necessary biologic function in maintaining balances. We see coyotes, cougars, owls, hawks and foxes in a different light than we did thirty years ago, and should see ourselves as sometimes unworthy managers of our environment.

Promiscuity has taken on a new meaning as the years have gone by. With the pressures of economic competition, we can no longer afford to raise scrub chickens, scrawny cattle, just corn, or even just "dawgs." We now realize that either we plan the heredity of the plants and animals we raise or we go broke. Fortunately, this idea is not simply one of prohibition and negation. Instead, it is one that shows us that when we do plan heritage we produce superior results, such as corn that will grow where it would not grow before, cattle that will resist heat and insects, and trees that will produce wood or fruit more efficiently than before. We can even predict what is likely to happen a few generations ahead if we cross two dogs of known properties. By sterilizing the males of some insects and permitting them to breed with the females, we have been able to control whole populations of insects dangerous to our interests. This science of planned parenthood holds great promise for the future. Great wisdom and judgment in its wide application must be forthcoming in the future.

Hugh Hammond Bennett

Preservation problems also hold our interest increasingly and ever more widely. If we can make a valuable biologic resource last longer it may relieve us of some of the difficulties of production. For example, we have reason to believe that when we milk a cow the lasting quality of the milk varies from the first milk taken to the last stripped from the cow. If this is so, why not use the long-lasting milk where such milk is needed? This morning I pulled into our post office behind a small truck from our artificial insemination plant that serves the dairy cows of New York State. The story back of that truck-load of sperm collected this morning, and used hundreds of miles away a day or so later, would have been considered fantastic three decades ago. One bull known to be able to father cows of high milk productive ability now may father 6000 calves a year where formerly thirty would have been the number. What a difference this can make in the milk check and prosperity of farm families who use what we know! Again, where do we go from here?



William T. Hornaday

Roger Tory Peterson

The preservation idea has gained and must gain wide application as our tempo of living increases. We have advanced this idea in many ways. By managing temperature properly, we have performed wonders. We have used high temperatures to eliminate the existence of destructive disease organisms and low temperatures to delay the action of others that might spoil organic matter. By temperature management, we can increase or decrease the growing period, can bring flowers into bloom on the very day when their market price is highest, can regulate the growth of chickens so that we need feed them a few less meals to bring them to their best productivity. The whole field of deep-freezing has come into general use in the last three decades and with it have come better diets available at reasonable prices for great numbers of people. (*Continued on page 144*)

Arthur A. Allen

Aldo Leopold

THE ACADEMIC DISCIPLINES

STUDY	Mammals	Birds	Cold-Blooded Vertebrates	Invertebrates
DEFINITION	Mammals have long been sources of food, fur, fun, fear and fancy, and our understanding and appreciation of them changes constantly. We shall always look to them for food, but chemistry is providing substitutes for the fur and hide; physics, through gas engines, has made horse collars no longer stylish. Only rarely need we fear mammals, but we shall always enjoy their association.	Birds are important to man economically, academically, esthetically and possibly romantically, and our appreciation of them changes rapidly. They are established parts of our lives. Poultry supports great numbers of people through production of flesh and eggs useful as food, and more recently in the study of medicine. Genetics and nutrition have joined with economics to make poultry study a burgeoning science of major significance to us.	Few things have changed more in the past three decades than our concept of the role of fishes, reptiles and amphibians in the scheme of things. Our expanding population has added strain to our demands for food, sport and understanding formerly borne largely by mammals and birds. We shall look increasingly to the water for food, and there we find the world of fishes.	Invertebrate animals preceded and probably will succeed vertebrates on the earth. Their interests will always be interrelated. Solution of their mutual and conflicting problems provide perennial challenges, which are being met by new forms of attack. To the extent that we use them to solve our problems our own difficulties may be resolved. The situation has fathered, recently, phenomenal discoveries of great importance.
ELABORATION	Studies of individuals and the making of collections and lists are being replaced by studies of groups of individuals, often in great numbers, by observing, inducing and interpreting behavior, and by studying the animal as a whole, with its associated organisms, and in a natural setting. Our new techniques of study may use some of the results of our old ways, but create a demand for refined study methods.	Great industries are supported by those who wish to kill, to photograph, to report on and to study birds. Sanctuaries to defend birds' interests are being established to protect them from an expanding competitive civilization. Poisoning campaigns directed against insects may well influence the fate of birds, and are being examined critically with this in mind. Laws are being passed and enforced to defend birds.	Significant lessons in population studies have come from experience in maintaining a supply of sport fishes, and practices in their management that would have been abhored are now practiced with profit to man and to the fishes. Serious observations of breeding, feeding and migration habits have contributed enormously to sensible management practices, which lead to survival and rejuvenation of populations of cold-blooded animals.	Studies of short-lived fruit flies, easily reared cockroaches, habit-bound wasps, large-bodied cecropia pupae have enriched enormously the study of heredity, nutrition, psychology and senescence, and accelerated our ability to use these and related sciences in attacking our problems. Emphasis on classification and identification has passed on to physiology, chemistry and physics, genetics and statistics with good results.
DEVELOPMENT	We cannot disparage the old techniques of listing, describing and collecting, but we recognize that the lessons gained are inadequate for our current needs. We are learning to manipulate living animals in their natural setting to gain ends useful and informative to us. Helpful have been The American Society of Mammalogists, and Andrews, Anthony, Bourliere, Burt, Hall, Hamilton, Kellogg, Miller, Murie, and Ralph Palmer.	We have moved from the stages of collection, listing and reporting to recognizing the significance of behavior of the living bird, and are finding in birds help in understanding the nutrition, genetics and general ecology of other organisms. Helpful here have been Audubon Societies, The American Ornithological Union, The Fish and Wildlife Service, Allen, Baker, Burt, Forbush, Murphy, Pearson, Peterson, Pough, Roberts.	Again descriptions, listings and classification practices are giving way to behavioristic and statistical studies, and the lessons gained and applied to the culture, harvest and processing of fishes and fish products are most encouraging, but problems of pollution and marine ecology are becoming staggering. Societies of ichthyologists, herpetologists, limnologists and marine ecologists have done remarkable work.	Thoughtless programs designed to control invertebrates by chemicals may have created as many problems as they have solved, largely because of their lack of selectivity and their effect on food chains of other animals. Management of mass populations of invertebrates calls for understanding basic problems and sound recognition of the needs of individuals. These are being resolved by pooling the lessons from all forms of science.
REPRESENTATIVE	Ernest Thompson Seton's *Lives of Game Animals*, and his popular books and superior illustrations, set a pattern of mammal study that has been hard to duplicate. He "led the pack" in emphasizing field studies, extensive notes, superior reporting by word, pen and brush, by indefatigable work over a wide geographic and time span, and by answering often unwarranted criticism with accelerated work of unquestioned merit.	Frank Chapman played an important role in accelerating our appreciation of bird study through his travels and his writings, of which his *Handbook of Birds of Eastern North America* set a pattern that has been followed and elaborated. Bird students have used effectively cameras, color and speed films and sound recordings as they have been perfected to stimulate an expanding interest in their favored field.	The A. H. Wrights, through voluminous publication, enthusiastic teaching have done much to develop a literature, and teaching and research personnel essential to meeting demands of society for a rational understanding and treatment of the cold-blooded vertebrates. Their lives and efforts serve as important links between the contributions of Jordan and the host of current students of cold-bloods of the sea and fresh water.	From hosts of able students of invertebrate zoology we elect to recognize Frank Lutz whose *Fieldbook of Insects*, novel approaches to the study of animals, stimulating example, indefatigable activity and delightful sense of humor helped many develop power to work effectively in this field. Associates include Buchsbaum, Comstock, Crosby, Hegner, Ewing, Metcalf, Miner, Needham, Palm, Pennak, Pratt, Sanderson and Wheeler.

THE ACADEMIC DISCIPLINES

Woody Plants	Non-Woody Plants	Wildlife as a Unit	Earth and Soils	Ecology as a Unit
Appreciation and use of woody plants has experienced phenomenal changes in three decades. No longer are trees solely sources of lumber. The multiple use idea has grown enormously and now forests are recognized as necessary habitats for useful and valuable forms of wildlife, as valuable cover needed to regulate the run-off of water, as excellent areas for recreation of many types and of increasing importance as wilderness.	While as yet we have not solved the problem of duplicating photosynthesis in a test tube or industrial plant, we are approaching that point and are a long way from the day when the herb doctor was the Delphic oracle who made herbaceous plants significant to us. Instead of the taxonomist, who devoted his full time to recognizing plants as they were, we now have the plant breeder who creates new plants.	As an academic discipline wildlife and wildlife management have only recently won distinguished standing. When *Nature Magazine* was founded there was no Wildlife Society, no Wilderness Society and the Fish and Wildlife Service was the Biological Survey. Many and substantial fellowships to advance knowledge and increase leadership in the wildlife field have been established and have justified sustained and increased support.	In the past three decades there has been a phenomenal increase in the recognition of the importance to natural history of soils and fundamental earth science. Intelligent management of plant and animal resources through soil management has progressed through application of the laws of heredity, physiology, ecology, chemistry, physics and economics. Man is becoming the master of his fate, largely through understanding of soils.	"Ecology, or Nature Study in its Broadest Aspects," has grown steadily and increasingly significant since George F. Atkinson, the botanist, so defined it nearly 60 years ago. Each has prospered to the extent that their common properties have been recognized. Ecology recognizes a natural history problem as a part of a whole, while the standard disciplines may recognize it as a whole in itself. Ecology is applied natural history.
Possibly the most spectacular developments have been associated with discovered uses of formerly rejected forest wastes, so that now we make building boards of once despised sawdust, cellulose and nylon from processed tree tops, plastics from many sources. In some ways, these processed products are superior to the natural material and their development has reduced the pressure on woody plant production.	Instead of exploring the hills for new plants we explore the plant cell, the chromosomes in that cell and the chemical and physical changes that take place in them, and we use our knowledge to develop new and better plants to meet our increasing demands on plants caused by our expanding population and diminishing habitats suitable for plant prosperity. Plant physiology and ecology are tools that lessen our fears of starvation.	The wildlife field is a special kind of applied ecology emphasizing vertebrate animals and their associated organisms and habitats. In its development, it has experienced the usual descriptive and survey stages, but has, with remarkable rapidity, recognized and put into practice the more modern although not necessarily more useful means of investigation. This has paid off remarkably well.	With the awakening of the public to the importance of soils, particularly top soils, we entered into a period in which calamity and fear of soil exhaustion ruled the thinking. More recently we have recognized the more rewarding philosophy centered on our ability to renew and improve our soils. This optimistic approach must supplant the pessimistic approach that served its purpose in calling a tragic situation to our attention.	Since ecology refers to relationships between organisms and environment we have an infinite variety of types. These include ecology of individuals, of species, of specific areas and of types of areas. These involve not only the space concept, but the time concept as well, where knowledge of ecology of the past and present may be used to predict the ecology of the future. This makes ecology most important in management.
The philosophy enunciated by Theodore Roosevelt and Pinchot has borne fruit in recent decades. We have learned not only how to grow, improve and manage our forests and forest lands but how to train the leadership necessary for this management. We have learned how to define the responsibilities of the individual, the state and the nation to meet the demands, and provided machinery for wholesome growth.	Books on range management, grassland improvement, wetland problems are taking the place of books on "The Plants of Anyland," but we still need the services of the critical, understanding and imaginative plant taxonomist, and the ingenious plant physiologist. Botany has gone a long way from its status as a hobby for young women to its role in plant industry and importance to all agriculture.	Prejudices relative to predators, misinterpretation of the significance of populations, waste in the field of harvesting the product, cruelty in management, and failure to recognize the values to different human beings have been or are being retired in preference to more sensible viewpoints and behavior patterns. Despite frequent dependence on a common environment, a tendency persists to separate the interests of fish and wildlife.	The contribution of the chemist and physicist, who have shown us how we can trace elements through the physiology of plants and animals, has removed much of the guess work from management of living things and improvement of soils for the support of living things. It has also developed an additional responsibility that places of influence be occupied by trained persons, or by those who can respect and support superior training.	A great danger in the ecology concept lies in the idea that sometimes exact studies of the parts of a whole may be unnecessary to grasp the whole. Technicians come to rely too heavily on generalizations. Human ecology is recognized as a connecting link between the natural and the social sciences. If it could unite effectively important aspects of the natural and social sciences, ecology would more than justify its recognition.
The American Forestry Association and its publications have exerted stimulating help to State and Federal agencies responsible for forest matters and to the associated park agencies. Prominent among the individuals responsible for this growth during these years was Charles Lathrop Pack and his two sons, currently represented by Arthur Newton Pack, now active in solving problems of the Southwest.	Without hesitation, we choose to recognize Liberty Hyde Bailey, whose centennial we celebrated in our ninety-fifth unit of this series. His vision, ability, dedication and industry, his publications, his administrative triumphs and his breadth of interest and talent did much to raise plant study to its present professional and civic dignity. He helped pool the plant resources of the world and stimulated technical investigations.	Probably no one has been more responsible for bringing dignity to wildlife problems and the wildlife profession that Aldo Leopold. His report on the Game Survey of the North Central States set a pattern for serious attack on a problem that had many ramifications. His text *Game Management* crystallized what was known, and provided a guide for leadership training and research. His *Sand County Almanac* became a model of literary skill.	There is little difficulty in recognizing that a major leader in increasing the public appreciation of the importance of soils and earth science is Hugh Hammond Bennett, who played such an important role in the development of the United States Soil Conservation Service. As Leopold made wildlife management articulate by his publication of his book *Wildlife Management*, so Bennett led the way with soil conservation literature.	W. C. Allee was one of the more effective protagonists of the ecology idea. In his writings, public lectures and classroom work he showed a phenomenal grasp of the details on which ecology is based and also exceptional ability to unite the offerings of all sciences on a problem. He showed great courage in presenting to hostile audiences ecological philosophies on which his studies had established convictions.

THE ROLE OF SKILLS IN CAUSING CHANGES

SKILLS	Mechanical	Manual	Literary	Special Guidebooks
DEFINITION	Understanding of natural history has been advanced tremendously by the development and use of machines. Microscopes help us see things we could only suspect. Cameras fix better than ever before things at great distances, of infinite smallness, at great speeds, in a variety of colors. Sounds that we cannot hear but which we know are significant can be recorded for study and analysis. X-rays are being used to accelerate heredity.	"The pen is mightier than the sword," and pens, brushes and scalpels, manipulated with consummate skill, have done much to change our interest in and our concept of the field of natural history. The manual skills of engineers have molded the topography of the earth to the betterment and to the detriment of living things. Skills in the use of firearms, once important to survival, have at times threatened animal species.	Izaak Walton, Gilbert White, Fabre and Van Dyke were the prototypes of the modern nature and science writers who through literary skill and printers' ink have done much to improve the average man's understanding of natural history. Without their interpretation and reporting of the findings of researchers, travelers and Nature lovers, public support of the field would not be what it is today.	The survival of many forms of wildlife depends, in part, on the outcome of the battle between printers' ink and gunpowder. One cannot doubt that printers' ink, on the pages of "field-guides," has done much to interest people in natural history. From interest has come understanding and from understanding have come convictions that have found expression in action. We must recognize the services of popular natural histories.
ELABORATION	Machines for recording and analyzing statistics, for using light, heat, sound and electricity to affect behavior, machines for varying humidity, pressure, for accelerating or retarding growth and other development, for collecting significant data at great heights above the earth's surface and at great depths below it, for performing intricate manipulations by remote control in exact sequences, have greatly aided interpretation.	The taxidermist, Carl Akeley, brought a new skill to his field when he abandoned the "stuffing of skins" and substituted skins put on meticulously measured manikins prepared from field notes on living animals. Our museums, influenced greatly by artists, have exerted a great influence on the appreciation of the public of the problems of natural history. We have come a long way from Audubon and pre-Akeley taxidermy.	Organizations of science writers, of outdoor writers and others have permitted producers of natural history literature to exchange ideas and establish a place for the Nature columnist in the daily press, the Nature reporter in outdoor magazines and the Nature and science writers as producers of books for the book stores. Each field seems to have produced its own group of skilled and gifted workers, and its own type and variety of effort.	Popular natural histories depend primarily, of course on the existence of valid source material. This has been effectively forthcoming from State units that have been responsible for presenting data on local natural history. In many cases these have been State conservation units, but State museums, State colleges and State education departments also have been helpful. Private units have entered the picture usually on a broad basis.
DEVELOPMENT	The opening up of each new avenue of investigation made possible by the development of new or of refined machines has made the natural history of thirty years ago generally inadequate for our current needs. This has called for the use of investigators with imagination and skill, with dedication of effort. These investigators must find the necessary financial, professional and social support to assure continued progress. In general, we have grown.	Often artists have successfully combined the results of their skills with the machines developed by man, but the artist has given us remarkable help and has grown greatly in effectiveness. "Ding" Darling's cartoons have challenged our sense of justice to oppose despoilation. Walt Disney has used effectively the cartoon, and then the animated cartoon, for the good of causes as well as to his own profit.	It is probable that much that has been written in the nature' history field has been of such poor quality, factually and otherwise, that writers have often interfered with rather than advanced public appreciation of the merits of natural history. Unfortunately the public has frequently given high financial support to inferior work in this field. Responsibility for integrity in reporting natural history to the public is highly important.	A survey of the magazines with the largest distribution was made a few years ago to determine the interest of their editors in conservation and natural history material. Some of the magazines that indicated lack of interest have since suspended publication. Others now, with surprising regularity, publish large and valuable articles useful in convincing the public at large of the importance of natural history.
REPRESENTATIVE	From this plethora of strategic factors influencing investigations, we elect here to recognize the work of Peter Paul Kellogg, whose mechanical skill has been applied particularly to the field of recording and interpreting the sounds of Nature and to making these available attractively and widely. As our first professor of biologic acoustics, he has been instrumental in building a whole new library of sounds of Nature.	We elect to present the artist, Louis Agassiz Fuertes, who probably did more than anyone else to revolt from the mapping technique of Audubon and make a picture a true representation of a natural history situation. He did this using the wash technique, water color, oil, and pen and ink, and he showed many other artists how they might improve their work.	It may be questioned if a modern writer has exceeded the skill of Dallas Lore Sharp in his *Turtle Eggs for Agassiz*, or *Five Days and an Education*. But we elect to recognize, in this category, Edwin Way Teale, who has in many ways been a modern Fabre dedicated to interpreting our own back yards in ways that can be duplicated satisfactorily by the person of average intelligence. His influence has been far reaching and sustained.	There is little doubt that, in considering the influence of popular natural histories, Roger Tory Peterson has played an important part. Able to present superior drawings, and paintings giving detail, he early recognized the importance of dealing also with impressions. His original field-guides departed considerably from what was currently popular, but they won overwhelming approval from the public.

THE ROLE OF SKILLS IN CAUSING CHANGES

Teaching Skill	Organized Effort	Junior Organizations	Government Leadership	"Watchdog Leadership"
The skill of the teacher is an important civic asset. The poorly trained teacher, particularly in the natural history field, may be a serious liability to a successful educational program. The present serious crisis in science education, as compared with that of the communist nations, must be due in large part to unwarranted public support of inadequate programs and teachers in the natural history field.	Without minimizing in the least the importance of the contribution of the individual genius, or the tireless sustained worker who may supply meticulous detail, we must recognize the services of organized groups of individuals dedicated to contribute their part to helping worthy causes. Independently their accomplishment might have been less, but united as they have been, they can raise funds, pool interests and make themselves felt.	Since 1923, there has been a phenomenal increase in the influence of youth organizations in the natural history field. Scouting organizations, recreational groups, and others began to develop power and volume. Much of this stemmed primarily from voluntary leadership stimulated by a nucleus of professional adults. This, coupled with other influences, has changed natural history work.	History is full of evidence that government support of an idea is a most effective influence in advancing a change. This has been particularly true in the natural history field, where it is impossible for qualified individuals at times to carry on necessary critical examination of problems, processing the findings into law, enlisting leadership necessary for success and enforcing rulings of recognized merit where enforcement is necessary.	Awareness of the necessity of general knowledge of natural history has been stimulated, as it should be, by many means. The growth in the number of national, State and local parks under the urge of private groups, the unrelenting pressure of dedicated individuals and groups of individuals aware of dangers, and realization that our expanding populations and civilizations are creating problems and affect natural history support.
Four major factors influencing success in a teaching program are—the program, the supplementary texts, the laboratory facilities, and, of course, the teacher. Texts and laboratory facilities are considered in two other columns. In all this field, during the past three decades, the influence of the professional educator in the pre-college natural history field has been on the increase and that of the trained scientist has waned.	Where organizations are inspired by political ambition, selfish mercenary aims, personal desire for aggrandizement, seeming satisfaction with the attainment of short-sighted goals or deliberate wish to perpetuate bigoted convictions, they may be dangerous. Fortunately, today, selfish interests have been often thwarted by the existence and dynamic activity of organizations dedicated to worthy causes.	The development of camps and camp sites used as training and instruction centers has provided outdoor laboratories through the land. There the academic philosophies taught in the schools can be put into practice. Sportsmen's groups have developed areas where the conditions for wildlife have been improved, and frequently these have been instrumental in improving the understanding of the average person on natural history matters.	Theodore Roosevelt was a pioneer naturalist who recognized the value of government in protecting the interests of the nation as a whole in the face of strong selfish interests. His forestry, park and wildlife programs were such that, without them, our present day efforts would probably not be so far advanced. T. Gilbert Pearson was able to combine government influence with science for bird protection.	Our urban civilization is expanding so rapidly that unless faced intelligently, more problems will be created than will be solved. Occupation of rich agricultural, food-producing land by suburban development, or by superhighways, or by irresponsible transient, seasonal populations may well remove forever what some think of as our richest heritage. The wilderness ideal must be stimulated and supported.
Our knowledge of science and of natural history has increased so greatly that exceptional ability is necessary to know what should be considered. The demand for good teaching has increased so much that unusual care should be taken to place adequately experienced, trained and gifted teachers in the strategic positions. Public financial support of teaching has become so generous that there is little excuse for not doing superior work.	There has been a great increase in the number of organizations, local, State and national. For the most part their purposes are in the public interest and unselfish. While these groups may differ in detail on some points, such difference are healthy and democratic. But more and more organizations have come to show a united front on major conservation issues.	Much of the effectiveness of work with young people under volunteer leadership has been possible because of the publication of such books as the handbooks for scouts, the periodicals for the same groups and the rewarding explorations available to those who may demonstrate skill in this field. Many times youngsters who have rebelled against the academic procedures in the schools have found in these activities stimulation for growth.	The conflicts between interests of land owner and citizen, between the interests of different States and groups of States, between State and Nation, and between different nations have been partially resolved by effective leadership. Natural resources, such as seals and salmon and migratory birds, have repeatedly been saved from extirpation by government action, and this support must be recognized and furthered.	There is great danger that the recreational urge may gain undue influence, that the bulldozer, engineer, and athlete may reduce our interesting natural topography to a monotonous speedway and athletic field, that our native wildlife may give way to landscape gardening and introduced species. Facing this situation are such useful organizations as the national parks groups, the Nature Conservancy and militant individuals.
Among the many superior teachers of natural history we recognize Arthur A. Allen as outstanding in this field. His efforts did much to bring ornithology to a dignified status at the graduate level but he has also had an enviable record as photographer, lecturer, researcher, writer, traveler and director of graduate programs. [We would like to name E. Laurence Palmer for his lifetime of achievement in Nature education. *Ed.*]	We elect as spokesman for such unity the cartoonist, militant conservationist "Ding" Darling. In 1936, he chartered a program to unite the efforts of "Sportsmen's Groups, Chambers of Commerce, Girl Scouts, Bird Clubs, 4-H Clubs, Women's Club's, Farm Groups, Garden Clubs, Future Farmers of America, Schools, Boy Scouts, and Civic Clubs" into local, regional and national bodies that would work for conservation.	From a host of those who have led in this field, we choose to recognize Ted Pettit, national leader in conservation for the Boy Scouts of America. Through his dynamic leadership he has overcome lethargy in the administration of his own organization; has stimulated originality in publications used by Scouts, has been primarily responsible for the growth of work in conservation at the national jamborees.	Possibly the outstanding figure representative of cooperation between government and public and private interests, skilled diplomat, and administrative leader, nationally and internationally, is Ira Gabrielson. His record we recommend for examination, his example we hope will be followed and his service we hope will always be appreciated widely and generously. His recommendations are based on high integrity.	It is most difficult to select a representative of workers in this field, which include many strange bedfellows with often unreconciled convictions. We cannot overlook the work of Aldo Leopold, of Olaus Murie, of the Packs and many others. We elect, however, to honor William T. Hornaday, whose *Thirty Years War for Wildlife, Gains and Losses in the Thankless Task* called attention effectively to a dangerous situation.

Edwin Way Teale

Ted Pettit

Jay N. "Ding" Darling

Ira Gabrielson

(*Continued from page 139*)

Light has been employed extraordinarily to advance the preservation idea. Exposure to lights of different wave-lengths, for different periods of time, at different stages of development of the involved organism has given us a powerful tool in natural history to apply to meeting our everyday problems. Similarly valuable have been the tools supplied us by our greater understanding of sound, of electricity, of chemical differences, and of physical properties. We have a new respect for time and of timing changes so that desired results may be obtained, and of advantageously combining the services available to us from different organisms at different times.

All of these, and other aspects of a changing natural history, are the responsibility of men and of women dedicated to service and gifted with skills and with opportunity. We have tried to call some attention to this story in the accompanying chart section.

Effective development of organisms frequently has been possible because of our being able to control what might be called climate. This "climate" idea may be appropriately applied not only to the physical properties of environment but to the psychological situation as well. The last thirty years have seen phenomenal development here. It may be as worth while for us to study the properties of human beings who have demonstrated their ability to serve their generation as it is to put all of our time on the study of an element, a compound, an organism, or a society. Our present society has seen fit to reward those who can invent and operate intricate machines; those who can illustrate, write, teach, organize and lead. We like to believe that this favorable climate has been responsible for our reasonably high standard of living. There may be reason to wonder where we are going from here; whether our involved economic system may break down when our indebtedness reaches a certain point; whether our health will break down when we increase the artificiality of our existence; whether our happiness will become a thing of the past when we wake up and possibly find that we have been enjoying an artificial prosperity, in an artificial environment, living on an artificial schedule in an artificial world. Maybe, when and if that time comes, we will fall back on fundamentals and find that we may have been shooting at the wrong goals for quite a while. We hope that society will be such that it is always possible for folks like you and me, with the help of the specialists, of course, to live what approximates a normal life. We want to be able to enjoy a good sunset, to listen with satisfaction to wind in the trees and surf on the shore and little things in the grass. We want to be able to smell something finer than sewage, to find pleasure in the way fur feels to our fingertips, and to recognize quality in the work of men and of women who make the most of their natural gifts and opportunities.

This ends the first hundred special educational inserts in *Nature Magazine*. It has been fun writing most of them. Only one number was completed and finally abandoned before publication. I fully expect to start the second hundred tomorrow and am equally confident that I shall never complete the two hundredth. I am sure, however, that, twenty years from now, we will still have natural history with us, that there is every possibility that in the next twenty years it will experience more changes than it has in the past twenty, that during that time it will help make the world a happier and better one in which to live and will offer greater opportunities than ever before.

I am also certain that Wheeler's *Dry-Rot of Academic Biology* will be as appropriate as it has been for the last twenty years, and that Nature study and natural history will still prosper as the continued study of reality. As J. G. Needham said of Nature study: "Come where the wild things are waiting outside and let your soul taste of the joys that abide."

Conservation Goes Aloft

By GORDON S. SMITH

Photograph by the Author

Mrs. Florence Parlett, the flying conservation worker of Anne Arundel County, Maryland, has flown many hours with Soil Conservation Service technicians and County planners in organizing plans to keep agriculture, housing and industry in their proper places in the County.

FLORENCE PARLETT is the mother of four boys; owner-manager of the Annapolis, Maryland, Airport; Civil Air Patrol officer, and member of several civic clubs, but she can still find time to show visiting Scout troops, school classes, or bird clubs her twenty-acre wildlife conservation area. Does this sound impossible? Mrs. Parlett, who seems to have enough ambition and drive for a half-dozen people, takes it all in stride, and enjoys it.

The Parletts own a tract of woodland a few miles from Annapolis, Maryland. When they moved in, they thought they were "out of town." But new housing, shopping centers, and super-highways gradually encroached on the natural landscape, and wildlife, Mrs. Parlett noted, was being crowded out. She began a project to help her furred and feathered friends.

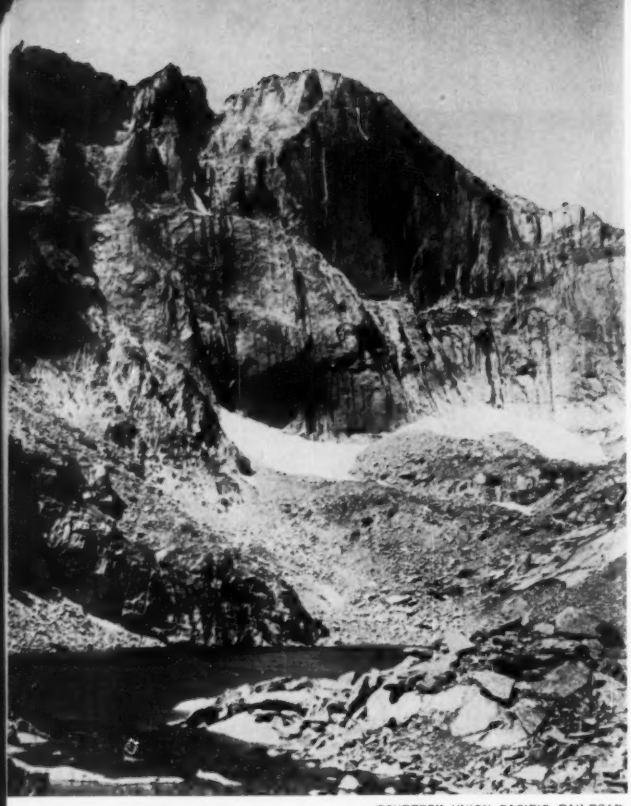
In 1951, Mrs. Parlett became a cooperator with the Anne Arundel County Soil Conservation District. Marshall Augustine, United States Soil Conservation Service technician working with the District, gave her advice on shrubs and trees best suited to the needs of wildlife. In six years, Mrs. Parlett has packed her area with berry-bearing shrubs. On her bird-lands are to be found the multiflora rose, bicolor lespedeza, autumn olive, silky cornel and coral berry, and in addition she has planted more than a thousand evergreen trees among her hardwoods.

One day Mrs. Parlett hired a bulldozer to dig a half-acre pond based on Soil Conservation Service designs. Before the 'dozer left, she had the operator dig five other little ponds scattered through the woods. Each is a wildlife colony today, and all are stocked with fishable bass and bluegills, to the delight of the Parlett boys and their friends. Mrs. Parlett has introduced wildlife, too. Bobwhite quail and pheasants have readily made themselves at home. Domesticated turkeys in pens and two Shetland ponies in a rustic corral also are among the guests.

A couple of years ago, Mrs. Parlett heard that the Soil Conservation Service was going out of the nursery business in New York State. She flew immediately to Big Flats, and found thousands of seedling pines available for the price of shipping. She arranged to send a truck from Annapolis, and as a result, there are a quarter of a million more trees growing in Anne Arundel County, largely due to her effort.

Mrs. Parlett has helped the cause of conservation on many occasions. Most recently, a County-wide zoning and planning program designed to deal with the urbanization problem benefited from her generosity. Soil Conservation Service technicians and County planners have flown many hours with Mrs. Parlett, getting aerial photographs and a bird's-eye view of the County. This, they say, has been a great help in organizing the new plan to keep agriculture, housing and industry in their proper places in relation to one another in Anne Arundel County.

Flying over the countryside, Mrs. Parlett has had a better chance than most people to see the changes taking place in Anne Arundel. As she puts it, "There's still plenty of room for farming, homes and industry in this County, if everyone makes the wisest use of the land."



COURTESY UNION PACIFIC RAILROAD

When water freezes, it expands by about one-ninth in volume and becomes an effective agent in wedging rock material from parent ledges. Much of the rock debris in this mountain photograph can be attributed to the powerful shattering action of ice, the solid form of water.

Life as we know it would be absent in

A World without Water

WHAT WOULD our world be like without water? What would happen to life on our planet if all the water were replaced by some other liquid? Could fish live in an ocean of acetone? Would the climate be the same if the rivers were filled with benzene? Could man go on living if the water in his blood turned to alcohol?

Water is such a familiar substance that we seldom give it a thought unless there is too much or too little of it on hand to suit our purposes. This colorless, odorless, tasteless liquid is so plentiful that we tend to regard it as something common, when, on the contrary, water is remarkably *uncommon* in several respects. If water had just been discovered yesterday, the ad writers would be having a field day describing its unique properties. They could truthfully claim that no other liquid could take the place of water as the chief ingredient of oceans, lakes, clouds, plants and animals. Without water, life as we know it would be impossible.

We sometimes refer jokingly to the fact that our bodies—like those of most animals—are three-fourths water, as if water were of no importance. But what would happen if the water in your tissues were replaced with some other liquid, such as alcohol? You would be "boiled" in more ways than one. The living processes of our bodies—like those of all organisms—generate considerable heat. If this heat were not dispelled, it could raise the body temperature as much as 300°F., a consequence of great import when we recall that a fluctuation of only a few degrees can be fatal to birds and mammals. It is the large percentage of water in

COURTESY CANADIAN NATIONAL RAILWAYS

Mountain climbing is a strenuous sport, and large quantities of heat are developed in the body during this or any heavy exercise. The blood, with its high water content, brings the heat to the surface of the body for removal, acting as a regulator of body temperature.

animal tissues that helps keep their temperatures constant, for water has a very high specific heat, which means that it can absorb and store more heat than any other liquid, with the exception of ammonia. We acknowledge this property of water when we say that "a watched pot never boils." Even cold-blooded creatures, like the frog, are protected against extreme

changes in body temperature by the water in their tissues.

Water wins the Oscar on two other counts as the ideal regulator of body temperature. It has greater capacity for conducting heat than any other ordinary liquid. Large quantities of heat are developed in the deeper regions of the body during muscular exercise, and this heat is conducted to the surface by the blood, which has a high water content. Water also helps to keep us cool because of its high latent heat of evaporation. It takes more heat to vaporize a given quantity of water than an equal quantity of any other liquid; twice as much as that required by water's nearest competitor. The constant evaporation of water from the lungs and skin thus has a maximal cooling effect in animals that pant or perspire. Fido may not understand this principle, but he makes good use of it when he sticks out his wet tongue to pant.

By

J. V. SHEPPARD

If water is of prime importance as a moderator of body temperatures, it is equally essential to the nutritive processes of life. We may not think of water as a particularly substantial item of diet, and yet living organisms, on the whole, take in and eliminate more water than all other substances combined. Any chemist can tell us one reason why this is so. He calls water the "universal solvent" because no other stable compound can dissolve so many substances in such large quantities. We can see the importance of this property when we recall that protoplasm, the basic material of all plant and animal tissue, is a collection of chemicals dissolved or suspended in water. Most of the substances that organisms require for their nutrition are dissolved in water, as are most of the waste products which they excrete. In the simple marine forms of life, sea water is the carrier of food and waste; in the higher organisms, the blood and body fluids take the place of sea water, which they closely resemble. Land dwellers might almost be described as individual sacs of sea water. While it is true that some animals drink little water as such, they derive water from their food or manufacture it as a product of metabolism. There are desert rodents that can live on a diet containing only ten percent of water. Oddly enough, the whale, which is surrounded by water, does not drink it; it obtains water from the marine creatures that it eats.

Life processes involve many complex chemical reactions that cannot take place in a dry state; hence water, by its ability to dissolve so many substances, provides a medium in which they can react. Water has still another property that makes it the ideal solvent. It is chemically inert. It does not react with most substances, and thus it can be used again and again as a solvent. Like a good hostess, water sees to it that other individuals meet and form groups, while she herself makes no strong attachments.

So much for the importance of water inside our bodies. When we look outside, we find much the same story. About seventy-two percent of the earth's surface is covered by the sea. There is literally water, water everywhere—in the soil, in the rivers, and in the vapor above the earth. And, wherever we look, water contributes to organic life by acting as a solvent. Rainfall, surface streams, and ground water are constantly dissolving chemicals out of the rocks. Some of this material is carried to the ocean, thus building up a supermarket of chemicals from which marine forms can take their pick. All elements found in sea water are absorbed by one or another of the ocean dwellers. The weathering of rocks is also of vital importance to landlubbers, because it contributes to soils that are the basis of all life on the land.

While water alone is able to dissolve many minerals out of the rocks, it becomes an even more efficient

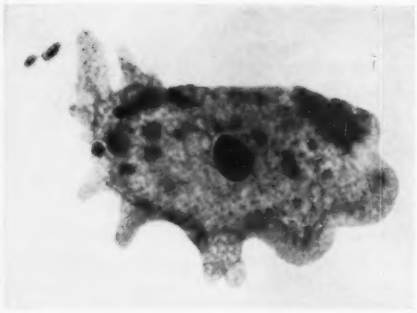
A dog makes good use of the cooling effect of evaporating water when it sticks out its wet tongue to pant.

Some animals drink little water as such. The whale, below, is constantly surrounded by water, but drinks none; this mammal obtains its water from the marine animals it eats.

AMERICAN MUSEUM OF NATURAL HISTORY

solvent when combined with carbon dioxide from the air. The union results in carbonic acid, which, along with water, can break down almost every variety of rock. Water distributes these rock minerals over the face of the earth in a variety of forms that plants can readily use.

While plants do not "drink" water or "eat" solid food, cabbages as well as kings require water for their nutrition. Through the process of photosynthesis, plants form glucose—a simple sugar—out of water and carbon dioxide. Glucose then is combined with minerals from the soil to make plant protoplasm. But these minerals would never reach the plants were it not for another remarkable property of water—its exceptionally high surface tension. You see an example of this force (sometimes called capillary attraction), when you put a narrow tube, open at both ends, into a glass of water and see the water rise in the tube. The particles in soil are arranged in such a way that the spaces between them correspond to tiny tubes, or capillaries. Thus ground water can rise as much as five feet through the soil to nourish plant roots. No other common liquid can match this climbing record, for no substance other than mercury has such high surface tension. The average liquid that had sunk more than two or three feet below ground level would be unavailable to plants. The rise of sap in trees and tall plants also depends, to some extent, on the climbing prowess of water.



Water is essential to the nutritive processes of life, and is called the "universal solvent." *Amoeba proteus,* above, can only draw its sustenance *in solution* through the membrane of its food vacuole.

The next time you drink a glass of water with ice cubes in it and one of the cubes clicks against your teeth, you will be aware of another characteristic of water that is of greatest importance to living things. Water expands on freezing, as any motorist must know, for that is why he puts anti-freeze in his car radiator. With only a few exceptions (alloys of bismuth and antimony, for example), most substances contract on freezing. In changing to ice, water expands about one-ninth of its volume, and, because it is less dense than water, it will float. Aside from the obvious advantage to skaters, this phenomenon favors aquatic life because the colder water expands and rises to the surface, so that the temperature of the water under the ice never drops below freezing point. If the rivers and lakes were filled with a substance that contracted on freezing, "ice" would sink to the bottom and stay there, possibly late into the summer, because the sun's heat would not be able to reach it. Bodies of such liquid in the cooler parts of the world might remain solidly frozen throughout the year.

You may be skeptical about the "warmth" of ice, but water actually freezes at a much higher temperature than most liquids. While 32°F. may seem cold to us, many forms of water life are well able to tolerate it. If the lakes were filled with ammonia, which freezes at –103°F., the chemical processes on which life depends would take place so slowly that all life would probably cease.

The fact that water expands on freezing works in other ways to make this planet hospitable to living things. Rain water seeps into tiny cracks and pore spaces of rocks. When this water freezes, it pries apart minute rock scales or mineral grains by the process of wedging, breaking down rocks to help build soils.

Meteorologists refer to water as the great moderator of climates and temperatures. We already have stated that water heats up slowly; hence the temperature of the oceans and rivers tends to remain fairly constant, and indirectly moderates the temperature of adjacent land areas. Ocean currents help to equalize the climate by carrying warmth from the equatorial regions to the Arctic, and cold water in the opposite direction. This tremendous capacity to distribute energy is made possible by the fact that water can absorb and hold more heat per pound, with less increase of temperature, than any other common substance on earth.

The high latent heat of evaporation of water, which helps keep Fido cool, also helps to equalize the temperature of the air. Evaporation is going on constantly wherever water is in contact with air. Thus, on a dry day in summer, the surface level of a lake may be lowered by as much as three-quarters of an inch by evaporation. Since more heat is required to vaporize water than any other substance, a great deal of heat thus is removed from the air. But the heat that disappears during evaporation has not been lost; when the vapor condenses to form rain, the heat re-appears and warms the air. No liquid other than water could bind so much heat during evaporation nor yield so much upon condensation. Hence its moderating effect on climate is at a maximum.

The full story of all the properties of water that go to make our planet "livable" can be told only in book form. In capsule form, we can say that water, which is the most common of liquids, is endowed with such uncommon properties that a world without water would probably be a world without life.

Rosemary for Pure Delight

By HARRIET BURKHART

Photographs by the Author

Rosemary is one of the mints, and bears the lipped, bilateral flowers for which the family is named. The blossoms mature into small, aromatic, nut-like seeds.

ALTHOUGH at my home in northwestern Pennsylvania I have a fair collection of hardy herbs, I had never seen rosemary growing before I first visited a friend at her California ranch a few years ago. I had thought of *Rosmarinus officinalis* as a modest plant with an inconspicuous blossom, like most of the common garden herbs. I was completely unprepared for a rosemary hedge of vigorous shrubs taller than I, spraying out and up in long shoots and branches so thickly set with short racemes of bloom that each one was like a garland in itself.

But trailing mat-like over the stone steps of my friend's garden is the opposite of the tall rosemary—the prostrate rosemary, *Rosmarinus prostratus*, a choice plant of great delicacy and elegance, bearing flowers of a more intense china blue than its taller relative. It is especially effective against the dull beige and gray of stonework. At the ranch the two rosemary varieties have crossed to produce a third—a hybrid that happily combines the most desirable characters of both parents. Planted about low rocks, it has at the same time both a shrubby and a creeping habit of growth, forming a dense cover thick with bloom. However, the same plant situated against a wall sends up tall shoots that flatten themselves against the stone surface as though espaliered there. There are also silver- and gold-striped varieties of rosemary, but the green-leafed type is the one popularly grown, because of the diversity of its uses in medicine, seasoning, ornament, and sentiment.

Almost as essentially tough as the native chaparral, rosemary seems to grow as exuberantly here as in its own Mediterranean climate. Although the English claim that rosemary flourishes in Britain as in no other part of the world, I cannot imagine that it could grow more luxuriantly anywhere than at this locality near the coast in southern California. The tallest of these hedge plants, five years old, measures a foot more than the maximum height of six feet given in *Hortus*, and the woody trunks exceed five inches in circumference. One of the pleasantest characteristics of rosemary is its habit of staying in bloom so much of the time, bearing seeds and flowers simultaneously. With some winter protection, this herb can be grown in colder parts of the country—even in New England.

As might be expected of a native of dry, rocky terrain, rosemary exhibits some of the same moisture-conserving adaptations as desert plants, as in the reduced size of its narrow, linear leaves that resemble the needles of balsam or fir in their leathery green upper surfaces and white, tomentose under surfaces. Then, too, the leaves curl back on themselves—*revolute* is the botanical term for this—so that less surface is exposed to the heat of the sun. All such devices prevent the loss of moisture to the air by transpiration through the leaves. But the plant does need a little additional water to carry it through the dry season in California.

The wild rosemary, *Ledum palustre*, has been extensively used by homeopathic physicians as a cure for the type of rheumatism that "begins in the feet and spreads upwards." This plant, also known as Labrador tea, is

found in cold boreal sphagnum bogs of the United States and Canada along with many plants of the heath family, and somewhat paradoxically shows almost exactly the same water-saving characteristics as plants that flourish in dry, parching situations. The answer seems to be that, although these bog plants grow with their "feet in the water," as it were, the coldness and acidity of the water reduce absorption and prevent full utilization of moisture. It is a case of water, water everywhere but scarcely a drop for the plants to drink!

Botanically, rosemary belongs to the Labiatae, or mint family, and bears the lipped, bilateral flowers for which the family is named, as well as the four-angled stems and opposite leaves of the mints. There are two delicate blue stamens curving out and down from the upper lip of the corolla-like miniature sickles, tipped with brownish anthers directly over the stigma in the center of the dainty blossom. The flowering axillary racemes, like the leaves, are borne opposite to each other or to a leafy twig, and may be placed quite close together at the terminals of the older branches, forming an attractive, twiggy outgrowth of leaf and flower. There is never any lack of insects—especially honey bees and the big, black carpenter bees—to pollinate the blossoms, which mature into an abundance of small, aromatic, nut-like seeds.

"I found a seedling apparently growing out of solid rock, where it had found a foothold in a tiny crevice."

Volunteer seedlings thus are numerous, and plants grown from seed are said to develop into the finest specimens. I found a seedling apparently growing out of solid rock, where it had found a foot-hold in a tiny crevice. The herb also is propagated by rooting cuttings, by root division, and, most readily of all, by layering.

The constituents of this pungently aromatic herb are a bitter principle, tannin, resin, a special camphor, and a volatile oil, much of which is contained in the flower calyxes. A hundred pounds of the flower-tops are required to produce eight ounces of oil, according to an authoritative English work on herbs. Consequently, the commercial oil is distilled largely from the leaves and less woody stems of the wild plant before it blooms, and comes largely from France, Dalmatia, Spain, and Japan. It is used in making eau-de-cologne and extensively in the form of *spiritus rosmarini* in hair tonics and shampoos, both for its fragrance and for its effect on the scalp. It is supposed to stimulate the hair bulbs and prevent baldness, as well as to keep hair in curl during exposure to a damp atmosphere. My hostess, an enthusiastic herb devotee, used to make a simple infusion of rosemary, which she put up in attractive bottles and presented to friends. Its action is both tonic and astringent.

But perhaps the chief use of the herb in modern times is as a delectable seasoning in poultry dressings, succulent dark-brown meat stews and ragouts, and other mouth-watering dishes. It is a "natural" in combination with sweet marjoram, thyme, or oregano. In early kitchen gardens it was so popular that it came to represent the influence of woman. Hence the proverb: "Where rosemary flourished, the woman ruled."

The wealth of sentiment and tradition connected with rosemary gives it a special position among the herbs. Since the ancients believed that it strengthened the memory, it became a symbol of the fidelity of lovers. Thus Shakespeare gives these much-quoted lines to poor Ophelia: "There's rosemary, that's for remembrance; pray, love remember. . ."

"As for Rosmarine," wrote Sir Thomas More, "I lett it runne all over my garden walls, not onlie because my bees love it, but because it is the herb sacred to remembrance, and, therefore, to friendship; whence a sprig of it hath a dumb language that maketh it the chosen emblem of our funeral wakes and in our buriall grounds." In many parts of Wales mourners at funerals still cast sprigs of rosemary into the grave on the coffin.

A curious belief persists that when a sprig of rosemary is buried with the dead, it sprouts and keeps on growing. In France, it once was the custom to put a bunch of rosemary in the hands of the dead, and Valmont Bomare actually states in his *Histoire Naturelle* that when the coffins were opened after several years, the plant was found to have grown so much that the leaves completely covered the body.

Indeed, the herb, cultivated in every garden for its scent, was used indiscriminately at both funerals and weddings, so that an early English poet, Herrick, said of it: "Grow for two ends, it matters not at all / Be't for my bridal or my burial." And another, Fletcher, wrote somewhat impatiently: "Well, well, since wedding will come after wooing, / Give her some Rosemary and let's be going."

Branches of rosemary, "richly gilded and tied with silken ribands of all colours," were presented to each wedding guest, and it was used so much for crowns on such occasions—Anne of Cleves, one of the many wives of Henry the Eighth, wore a wreath of rosemary at her wedding—that the old botanical name for the plant was

Rosmarinus coronarium. The gardener at my friend's ranch, a young Hungarian recently arrived in this country, has a great fondness for this herb, which he says still is grown in his homeland primarily for use at weddings, although it seldom blooms and is less than half the height it reaches in California. He had never heard of using it in cooking.

Rosemary was long regarded as an efficacious brain tonic, which soothed the nerves as well as strengthened the memory. The Romans and the Arabians prescribed it to restore speech after a stroke, and rosemary wine—prepared by infusing the flowering tops in white wine for a few days—is a cordial for the heart, probably because of its camphor content.

A spray of rosemary commonly was carried in the hand as a protection against the smells and diseases so prevalent in London before the great fire. It was so frequently burned as incense in early religious ceremonies—and later in hospitals as a supposed fumigant—that the old French name for it was *Incensier*. It gives off a potent fragrance when burned, and the spicy scent of a green branch laid on the hearth to smolder will pervade the whole house.

Part of "dark-spiked" rosemary's charm admittedly lies in its background of association for most of us, and especially for me. Having become acquainted with the living plant through a friend, I have come to think of it as a symbol of a cherished friendship. But, all such considerations aside, rosemary has a subtle quality of grace and refinement that sets it apart from ordinary garden plants—a sort of fragility strange in so sturdy a shrub.

Looking at the rosemary in the slanting light of early morning or late afternoon, I can appreciate the appropriateness of the ancient name, *Ros marinus*, "dew of the sea," given to the plant by Pliny at the dawn of the Christian era; for the myriad pale blue blossoms seem to drift like mist from the sea around the strong woody branches and dark shining leaves, surrounding the hedge with a sort of glow. A perpetual aura of fragrance hovers about it, too, becoming more noticeable if one brushes against the branches of this spicy plant.

"I was completely unprepared for a rosemary hedge of vigorous shrubs taller than I, spraying up and out in long shoots. . ."

After several visits and greater familiarity with many other plants of more obvious beauty in other California gardens, I still come back to the rosemary as the most beautiful of them all. As I sit writing in the thin winter sunshine, just outside the circle of shade thrown by the old live oak, the blossom-laden branches of the rosemary hum with bees and bend under the slight weight of goldfinches in quest of the aromatic seed kernels. Audubon's warblers, too, colorful even in winter plumage, flash their golden rump-spots as they flit nervously about, warbler-fashion, through the inner maze of upright shoots and arching branches, attracted by the multitude of insects around the blossoms. Towhees, wintering hermit thrushes, and other ground-loving birds run along under its hospitable shelter, and wren-tits seem to consider it a normal extension of their native chaparral.

As I glance down at the clump of rue beside the rosemary hedge, lines from *The Winter's Tale* come to mind: "There's rosemary and rue; these keep seeming and savour all the winter long." But if there were no other motive for growing rosemary than pure delight, I think this would be reason enough.

LOVE HAS NO LIMITS

Beauty sits there in a lovely squirrel —
All plushy gray, white tummy, bushy tail —
She holds a piece of bread between her paws
And looks as if she'd found the Holy Grail!
I couldn't love her more were I her mother,
And of sons and daughters had no other.
She often sits and peeks right in my window —
With folded hands across her velvet chest —
With head on side, and eyes a merry twinkle,
She merely sits and knows I'll do the rest!
I feed her, yes, but what she does for me
Is more than words can say in poetry!

Shirley M. Cooper

Honey

By ALEXANDER B. ADAMS

Illustrations by Carolyn Copp

"After some discussion, we decided to let Honey run loose on the second floor, where the stairs, which she could not negotiate with her short front legs, would serve as an effective barrier."

THERE WAS no one upstairs, our guests were sure, and yet they could hear the metal scrap baskets in the bedrooms being knocked over, one after the other, like ninepins. Finally, when the fourth crash rang through the house, they looked at us in a manner that obviously demanded an explanation; so we told them about Honey, our pet skunk.

Night having fallen, she was making her regular rounds of the scrap baskets to see if they contained anything interesting. Standing on her rear legs and clawing at the baskets with her front paws, she would topple them over and crawl inside in search of hidden treasures, bringing the whole accumulation of litter along with her when she backed out again. Of course, even from a skunk's point of view, she never found anything worth while, but she never gave up hope; and all the time she lived with us, she scurried in and out of our scrap baskets with the curiosity that was basic to her character.

Making explanations is, we found, a concomitant of owning a pet skunk. Even when we walked her on a leash across our field, we avoided the far edge near the road. Otherwise passing drivers would peer at us and jam on their brakes to take a second look. Once they had stopped there was no escaping the barrage of remarks. Or, if we drove to the nearest small town with Honey on the back seat—which we did, for example, when we took her to the veterinarian for "shots"—we invariably faced such questions as, "Is that a real skunk?" or "Where did you get her?" and "What in the world do you want a skunk for?"

This first two questions were easy to answer; but it took time to reply to the third, because it meant telling about our family and our love for the outdoors. For it was this that led us to buy Honey as a birthday gift for our youngest son. We were resolved, for one birthday, to get him something different and new, and for ideas we naturally turned to the outdoors. The list of possibilities was long; but after much studying and consultation with wildlife experts, we finally decided that skunks—in spite of their undeserved reputations—best combined the qualities we were seeking; and so we ordered one.

This was not difficult. To our surprise, we discovered that, in the United States, there are a number of wild animal dealers whose primary business is supplying zoos. Almost anything that lives may be purchased from—or through—them, and at last the day came when the express agency in a nearby town notified us that the new member of our family had arrived safely.

"...they could hear metal scrap baskets in the bedrooms being knocked over..."

As soon as we brought her home, we took her out of the shipping crate and cradled her in our arms, watching the sunlight play on her glistening black coat, her pure white cap, and the two white stripes running down her back. Then, because she was weary from the long trip, our son put her in the large cage that he had built. But instead of sleeping she wanted to go exploring and, to our surprise, climbed right out of the cage again through the mesh of the wire. Of the many lessons that Honey eventually taught us this was the first: Skunks have relatively small bodies, and it is only their thick coats that make them appear large.

This first experience posed a problem. We did not want her to escape and possibly be hurt. After some discussion, we decided to let Honey run loose on the second floor of the house, where the stairs, which she could not negotiate with her short front legs, would serve as an effective barrier. Of course, this was perfectly safe for the household. The odor, for which skunks are famous, originates in two glands located

underneath their tails. These, as in the case of Honey, can be removed by a skilled technician in a simple and almost painless operation. In the behalf of visitors, we felt obliged to take this precaution. Skunks also will quickly learn to use a sand pan.

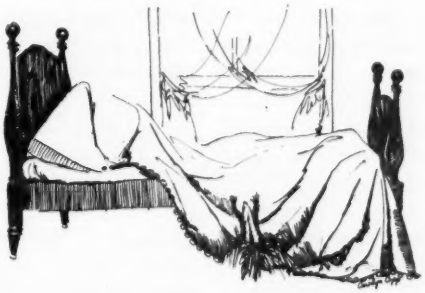
Before Honey could move into her new quarters, she had to be introduced to the dogs. Our pointer merely yawned at her, and Honey yawned back, the two of them bored with each other. With our Irish terrier, however, matters took a different turn. From the beginning Honey took a warm liking to the terrier, and scampered along behind her whenever the terrier wandered through Honey's part of the house. Then, one day, the terrier decided on a new game. She let Honey come close behind her, then suddenly whirled around in a playful mood. But Honey was gone, having darted under the bed. By the time the terrier had discovered how she had disappeared, Honey had quietly slipped out of the room, leaving the terrier mystified and disgruntled. But in a short time Honey was back again, taking up her accustomed place at the terrier's heels. Once more the dog whirled, once more Honey disappeared; and while they always remained fast friends, Honey would never let the game go any farther.

Honey also developed a strong affection for my wife. After the children left for school each day, Honey would follow her around, watching her do the housework and especially enjoying the bed-making. As my wife moved from side to side of each bed, Honey would run underneath, racing to meet her. Both of them took pleasure in this game, which they played every day.

Then there was the day that the skunk found out about flowerpots. Our son had several plants in his room, and Honey decided to look them over more closely. Pursuing her usual method of investigation, she carefully tipped over each pot and spread its contents on the floor. On another occasion she handled his cocoon collection in the same manner, ending up by strewing cocoon silk throughout the room. From these two experiences we learned to keep interesting objects out of her reach—but this was no solution to the bedspread problem.

Honey loved bedspreads. She had discovered, one day, that she could take the spread off our son's bed by clawing at the edge of it. Inch by inch it came down, until she had it on the floor. There was no use putting it back, because Honey, once having learned that she could do something like this, never forgot. Either we went without bedspreads altogether, or we gave her one of her own. Since we had none to spare we substituted an old slip cover, placing it on the floor of our son's closet, where it would not be in way. Honey was delighted with this new acquisition, and gradually shaped it into a tunnel with a nest for herself at the far end, the whole forming a close approximation of the burrows in which skunks normally live.

"She had discovered, one day, that she could take the spread off our son's bed by clawing on the edge of it."



Other hidden places were also a source of pleasure for Honey. If we left a paper bag on the floor, she would curl up inside it. She also liked to climb behind the volumes on the lowest shelf of our son's bookcase; she enjoyed the spot between the clothes hamper and the wall; and one time, right after Christmas, she snuggled down into the box holding the Christmas ornaments and was almost packed away with them in the attic.

One night, after we had gone to bed, we heard a scratching sound in our closet. At first we thought that the noise might come from squirrels, but an investigation showed that Honey had clambered into the lowest drawer of a large bureau. The drawer had been left slightly open; but instead of climbing in the front, Honey had gone underneath the bureau and then in from the back. She did this on several other occasions later on, and it seemed to emphasize her natural instinct for picking a nesting place at the end of a long tunnel.

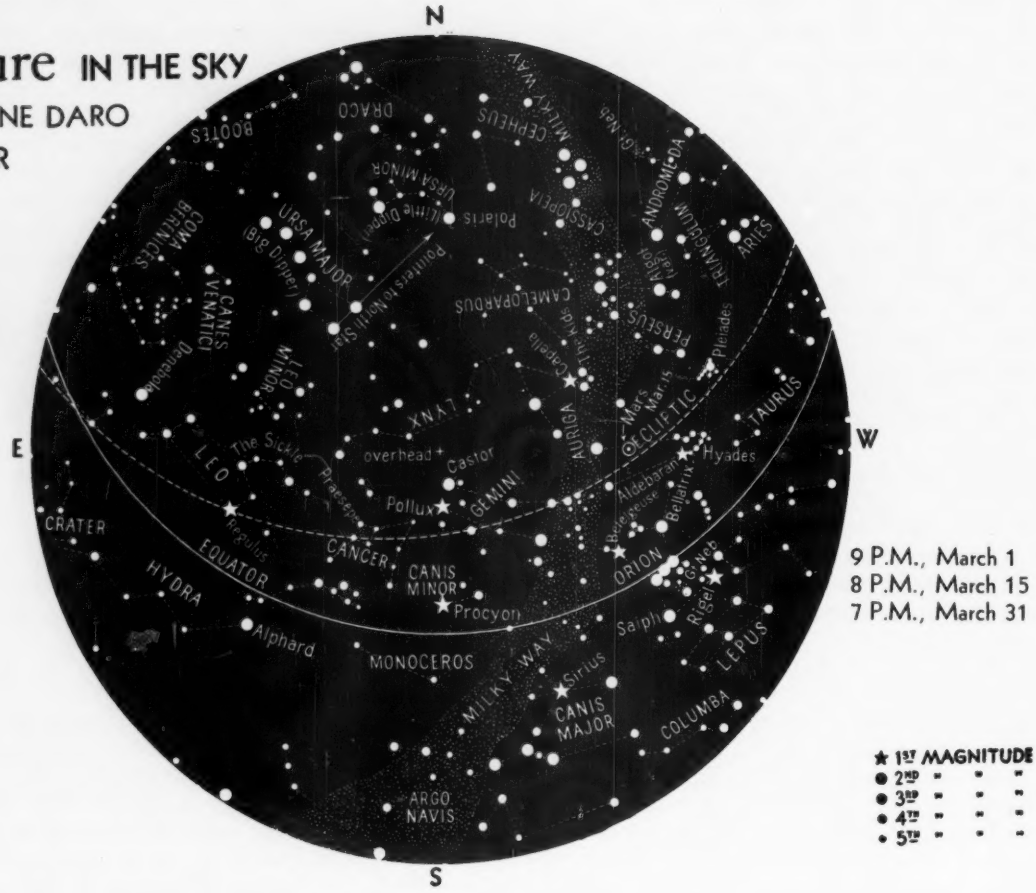
Although her habit of hiding sometimes caused difficulties, feeding her, on the other hand, was no problem. Skunks are omnivorous and will eat almost anything. But Honey's favorite food, as well as sport, was bugs—any kind of bugs. The first time that we noticed this was one day when our son had her out on a leash. While they were walking together through a field, Honey suddenly leaped forward, began digging with her front feet and, to our amazement, quickly uncovered an ant tunnel. She did this again and again on subsequent walks, guided by some instinct that we could not divine. She also acquired the habit of hunting for thistles, which she would tear apart with her front feet, removing the ants that were invariably found inside.

Of all insects, however, she most preferred grasshoppers. The moment she saw one, she would leap toward it and catch it with her front feet, much as a cat captures a mouse. So, as a special treat one August day when the fields were full of hoppers, our son went out and brought in a handful, turning them loose in his room. As we watched the speed with which she caught them, we found ourselves agreeing with the notion that a single skunk may serve as guardian angel to at least an acre of garden.

But in addition to amusing herself with grasshoppers, Honey had some serious duties to perform. We (*Continued on page 160*)

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

The Date of Easter

ALTHOUGH THE setting of the date of Easter is an ecclesiastical matter, the rules that govern it have been gradually modified over the centuries on the basis of improved astronomical knowledge.

During the early centuries of the Christian Era, the date of the celebration of Easter was influenced greatly by the preferences of the local clergy, and was inevitably tied to the calendar reckoning used in the various countries. The Easter date was always related in some manner to the occurrence of the first full moon following the spring equinox (known as the "Paschal Full Moon"). At the Council of Nicea, held in 325 A.D., the usage was unified—at least theoretically—and the date of Easter was set at the first Sunday following the Paschal Full Moon. Ecclesiastical calendars, however, did not rely on direct astronomical means for the determination of this full moon. Instead they made use of a number of cycles and auxiliary quantities based on accepted values of the length of the year and of the lunar month.

Although these cycles were accurate enough for a span of a century or two, their discrepancies with actual astronomical values gradually accumulated over the years. Simultaneously, the same embarrassing departure from astronomical values was happening to the Julian Calendar. The latter, introduced by Julius Caesar, had been based on the assumption that the length of the year was exactly 365¼ days. This value, unfortunately, was too large by a small fraction, with the result that the Julian Calendar, in fact, was using too many leap years.

By the spring of 1582, the Julian Calendar had lost

about ten days on the sun. While the astronomical spring equinox was now occurring on March 11, the ecclesiastical calendars were still assuming that it took place on March 21. In consequence, all the movable church festivals were being celebrated too late in the year.

Much concerned with these matters, Pope Gregory XIII instituted a revised calendar. Wishing to restore the date of the equinox to March 21, and have it remain on that date in subsequent centuries, he ordained that the day after October 4, 1582, be called October 15, 1582, and gave new rules for the use of the leap year. Unfortunately, he retained the use of ecclesiastical cycles—somewhat improved—for the determination of lunations. This means, naturally, that there still remains a discrepancy between the ecclesiastical and astronomical calculations of the Paschal Full Moon. It may be noted in the example below, that the Paschal Full Moon for 1959 falls on March 23, while, astronomically, the moon will be full on the following day.

Additional rules also were provided to insure that Easter would never occur before March 22 or later than April 25. The adoption of this *Gregorian Calendar* was, of course, immediate in Roman Catholic countries. The Protestant countries were more reluctant. The British Empire eventually adopted it in 1752, and it is generally assumed that this also is the date of its introduction in the American colonies. Various efforts were made by the German, Dutch and Swedish Protestants to abandon the ecclesiastical comput, and to determine the date of Easter by astronomical tables. Today, only in the Netherlands does the law require an astronomical reckoning.

The ecclesiastical cycles on which the computation of Easter is based are: the Golden Number, the Epact, and the Dominical Letter. The Golden Number is the rank of the year considered in a nineteen-year cycle, lunations recurring essentially on the same date after nineteen years. The Epact is the age of the moon on the eve of the New Year; that is, the number of days elapsed on January 1 since the last new moon of the preceding year. The Dominical Letter is defined as follows: If the seven letters A to G are assigned consecutively to the days of the calendar, and repeated in that order throughout the year, starting with A for January 1, the same letter will always designate the same day of the week. The Dominical Letter is the one that corresponds to Sunday in the year considered (February 29 receives no letter in leap years, so that a different letter is used for January and February than for the rest of the leap year). In 1959, for example, January 1 was a Thursday; therefore the following Sunday was January 4, giving D as the Dominical Letter.

For the sake of simplification, the rules given below apply only to the twentieth century. Only the last two digits of the year are to be considered in the calculations, such as 59 instead of 1959. Divisions are carried to the integral part only. For example, 13 divided by 4 equals 3 and the remainder is 1, since 3 times 4 equals 12. The examples in parentheses are for 1959.

The first step in the calculation of Easter is to find the Golden Number of the year: Add 1 to year (59 + 1 = 60). Divide by 19 and find remainder (60 : 19 = 3, remainder is 3). This is the Golden Number. If the remainder is 0, as for 1975, the Golden Number is taken as 19. We may now proceed to the second step.

The second step is to find the Epact: Subtract 1 from Golden Number (3 − 1 = 2). Multiply by 11 (2 x 11 = 22). Divide by 30 and find remainder (22 : 30 = 0, remainder is 22). If remainder is 0, use 30 instead. Subtract 1 from remainder (22 − 1 = 21). This is the Epact. At this point, if the Epact is 24, as in 1962, or 25, as in 1973, increase it by 1.

The third step is to find the date of the Paschal Full Moon: Subtract the Epact from 54 (54 − 21 = 33). Divide by 30 and find remainder (33 : 30 = 1, remainder is 3). Add remainder to 20 (20 + 3 = 23). Divide by 31 and find remainder (23 : 31 = 0, remainder is 23). This is the date of the Paschal Full Moon. If the number thus obtained is greater than 20, it is a March date (March 23 for 1959). If it is smaller than 19, it is an April date. If it is 0, as in 1961, the date is March 31.

The fourth step is to find the Dominical Letter: Divide the year by 4 (59 : 4 = 14). Add quotient to year (59 + 14 = 73). Divide by 7 and find remainder (73 : 7 = 10, remainder is 3). Subtract remainder from 7 (7 − 3 = 4). This is the Dominical Letter, taking A for 1, B for 2, and so forth. Thus, for 1959, the Dominical Letter is D.

The date of Easter can now be found as follows: Add 10 to Paschal Full Moon if in March, or 6 if in April (23 + 10 = 33). Subtract the Dominical Letter (33 − 4 = 29). Divide by 7 and find remainder (29 : 7 = 4, remainder is 1). Subtract remainder from 7 (7 − 1 = 6). Add result to date of Paschal Full Moon (March 23 + 6 = March 29). This is the date of Easter. If the final result is a March date greater than 31, as in 1961, subtract 31 and consider it an April date. For example, March 33 would be taken as April 2.

Test your skill and verify that in 1960, the Golden Number is 4, the Epact is 2, the Paschal Full Moon is April 11, the Dominical Letter is B, and the date of Easter is April 17.

GALACTIC SYSTEMS

No need to worry that one stands
In this air-bubble deep down under.
One has enough when one expands
A cell of sight, an inch of wonder.

Daniel Smythe

In the month of March, the New Moon will occur on March 9 and the moon will be full on March 24.

The vernal equinox, marking the beginning of spring in the northern hemisphere, will be reached on March 21, at 3:55 a.m., Eastern Standard Time.

Mercury will be an evening star (*Continued on page 160*)

Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

Differing Study Types

IT MIGHT BE WORTH WHILE to suggest a few definitions of Nature study, science, natural history and ecology as given by some of their more effective leaders. In 1897, L. H. Bailey wrote, "Nature-study, as a process, is seeing the things that one looks at, and drawing the proper conclusions from what one sees. . .it is positive, direct, discriminating, accurate observation. . .It is designed to help one understand why the thing is so or what it means. . .It involves the desire to know more. . .It develops a keen personal interest in objects and phenomena."

Anna Botsford Comstock said of Nature study that "it is, despite all discussions and perversions, a study of Nature. It consists of simple truthful observations. . ."It is "based upon the study of life and physical conditions which encourage or limit life." "It is characterized by the same accuracy" as science. "It is an effort to make the individual use his senses instead of losing them."

James G. Needham wrote of Nature study—

"The trees and the skies and the lanes and the brooks
Are more full of wonders than all of the books.
And always outside you can find something new;
You never are lacking for something to do;
You never hurt others, or get in the road
In taking the pleasures by nature bestowed:
For there's room on the shore where the great tides roll,
And freedom and peace that are good for your soul;
There's hardly a way you can have so much fun
As in being outdoors with the brooks as they run,
With the birds as they fly, and the stars as they shine,
With the drift of the years as they rise and decline.
It doesn't cost much and it doesn't take long
To get your ear tuned to the mighty world's song.
It brings in its train no unpleasant regrets,
And the farther you go the better it gets.
So come where the wild things are waiting outside
And let your soul taste of the joys that abide."

Basic validity

Think of the mistakes the science educators would have avoided had they insisted on recognizing the validity of the basic Nature study philosophy of seeing what one looks at, and drawing proper conclusions from what one sees.

Science has been defined as being "organized common sense," but apparently some elementary textbook writers and writers of high school texts have preferred to consider it "organized nonsense."

Karl Pearson defined science as, "a classified index to the successive pages of sense perception which enables us readily to find what we want." Then another defines it as, "a complement of cognitions, having in point of form, the character of logical perfection, and, in point of matter, the character of real truth."

It may be difficult at times really to define the differences between Nature study, science, natural history and ecology. In fact, it may not be necessary to do so since there are so many definitions of each. Anyway, it may be worth your while to give this whole subject some thought, and to get some suggestion of how natural history, at least, has changed since *Nature Magazine* was first published in 1923. Our special insert this month should be helpful.

Nature study, of course, is a broader term than natural history, and yet it may depend on how we wish to define it. In 1851, more than one hundred years ago, Philip Henry Gosse wrote: "That alone is worthy to be called Natural History, which investigates and records the condition of living things, of things in a state of nature; of animals, of *living* animals; which tells of their 'sayings and doings', their varied notes and utterances, songs and cries; their actions, in ease and under the pressure of circumstances; their affections and passions towards their young, towards each other, towards other animals, towards man; their various arts and devices, to protect their progeny, to procure food, to escape from their enemies, to defend themselves from attacks; their ingenious resources for concealment; their strategems to overcome their victims; their modes of bringing forth, of feeding, of training their offspring; the relations of their structure to their wants and habits; the countries in which they dwell; their connexion with the inanimate world around them, mountain or plain, forest or field, barren heath or bushy dell, open savanna or wild hidden glen, river, lake or sea; this would indeed be zoology, i. e. the science of *living* creatures. And if we have their portraits, let us have them drawn from the life, while the bright eyes are glancing, and the flexible features express the emotions of the mind within, and the hues so often fleeting and evanescent, exist in their unchanged reality and the attitudes are full of the elegance and grace that free, wild nature assumes." He says that closet-science "take its true place as the handmaid of Natural History." This is quoted from the introduction of Gosse's *A Naturalist's Sojourn in Jamaica*, to which reference is made in our educational insert this month.

Ecology defined

In the introduction to *Principles of Animal Ecology* by Allee, Emerson, Park, Park and Schmidt we read: "Ecology may be defined as the science of the interrelation between living organisms and their environment, including both the physical and the biotic environments, and emphasizing interspecies as well as intraspecies relations. The *living organism* may be defined, though somewhat incompletely, as a physicochemical mechanism that is self regulating and self perpetuating, and is in process of equilibration with its environment. The *environment* of any organism consists, in final analysis, of everything in the universe external to that particular organism." These authors go on for a dozen pages elaborating the idea

and for 837 pages giving further elaboration.

It might seem from these three examples that ecology, natural history and Nature study have much in common but that their proponents may vary in their use of the English language. If we bring in further the Wheeler discussion on "Academic Biology," as touched on in the insert, we should have enough to think about to last us for a while. Add an hour or so reading Liberty Hyde Bailey's *The Nature Study Idea*, and maybe a little while reading his *Wind and Weather*, and I rather think that you will feel better about the study of life.

Fortunately, changes are outstanding characteristics of living things, and so we feel it has been worth while to point to a few changes that have taken place in this whole realm of human experience. We will leave it to you to implement these ideas into useful doctrines for application to your own life and opportunities. We do not choose here to consider the role of science in general, except as it "serves as the handmaid to Natural History." If it does not serve as the handmaid to something, it, like academic biology, may suffer from dry-rot.

Conservation Program

Half a million Camp Fire Girls are participating in a long-range conservation project of this youth organization that was commenced last November with simultaneous tree-plantings in communities throughout the country, *Nature Magazine* has been informed. In many areas, Camp Fire Girls are taking a tree census to determine the number of different varieties, their state of health, and to find locations where more trees are needed. Thousands of trees will be planted, many of them raised from seedlings by the girls themselves. Members also are working on improving streams to prevent erosion, and ground cover will be planted in many suitable places to help preserve wildlife. In urban areas where large-scale tree planting may not be practical, Camp Fire Girls are making a survey of outdoor recreational areas to determine whether improvements, expansion or creation of new recreation facilities may be necessary. The slogan for this long-range conservation program is *She Cares—Do You?*

Chemistry Slide-Rule

The Graphic Calculator Company of Chicago, Illinois, has placed on the market a chemistry slide-rule that predicts whether or not chemical reaction is possible for 10,000 different chemical equations. Called the Graphic Chemical Predictor, this plastic instrument is said to simplify the balancing of even the most complex chemical equations with a spin of the dial, making it a valuable device for student, teacher, and technical person alike. The calculator is priced at $1.95, and may be obtained from the Graphic Calculator Company, Department DH, 633 South Plymouth Court, Chicago, Illinois. The company will be glad to furnish additional information upon request.

Predicting Red Tide

It now may be possible to predict Florida's "red tide," one of Nature's most spectacular phenomena, months in advance, says the Smithsonian Institution, of Washington, D. C. Scientists at the University of Miami have arrived at a complicated formula combining oceanographic and weather data that attempts to forecast conditions suitable for explosive expansion of a species of microscopic water plant responsible for the outbreaks that color waters of the Gulf of Mexico red, kill millions of fish, and fill the air with an irritating "gas." The formula can, at least, forecast years when the "red tide" probably will not occur and years when it is more likely. During outbreak years, as many as sixty million dinoflagellates—microscopic plant-like animals responsible for the "tide"—have been recorded in a single pint of water, and the Institution notes that such outbreaks seem to depend on precisely the right amount of Gulf and fresh water being mixed at just the right temperature.

A Reorganization

Harold Palmer Piser, managing director of the Arbor Day Association, has announced that the association will be reorganized and reactivated during the early days of March, and that a meeting of interested persons will be held in New York City March 6 and 7 for the purpose of electing six members of a board of directors, a president, vice-president, secretary and a treasurer.

THE Nature CAMERA

By EDNA HOFFMAN EVANS

Words and Meanings

EVERY AGE, OCCUPATION, AVOCATION, AND interest group has a language of its own. While the people concerned may all speak the same national language and use the same words, the things they talk about are different. So, often, are the meanings of the words they use.

One has only to listen to the chatter of a group of "teen-agers" to realize what a specialized brand of "slanguage" they speak. Nor are their elders much different; consider, for example, the varied meanings the word "strike" may have when used by a labor leader, a fisherman, a bowler, and a baseball fan!

We photographers (hobbyist or commercial) have our own special vocabulary. Besides a general photographic vocabulary that we share in common, we also use a more specialized set of words in whatever phase of photography it is that holds our major interest. Beginners find our photographic "lingo" most confusing—and even those of us who have been clicking a shutter for years are occasionally baffled by some new word that has crept into the field.

The following is a list of the words with which I think most serious camera enthusiasts should be familiar. I will welcome additions to it from readers in the event that I have omitted anyone's pet term.

Backlighting—lighting that comes from behind the subject and makes it stand out from a darker background. This produces a light fringe or "halo" effect; it adds sheen to hair and accents its soft texture. Backlighting produces interesting effects with translucent subjects.

Burn-in—a process used in enlarging whereby a portion of the print is given a longer exposure so that details may be emphasized or light areas darkened.

Burn-up—means to "badly overexpose." In black-and-white, the negative is very dark; in color, a "burned-up" transparency is light.

Busy—applied to a picture that is confused as to subject, contains many distracting details, and has no one main center of interest. It is also said of backgrounds showing the same characteristics.

Crop—cut out or eliminate some portion of the picture to remove unwanted material or improve composition. This may be done by actual cutting, by enlarging, or, in color transparencies, by using an appropriately-sized mask to cover the undesired portion.

Definition—the fineness of detail in a negative or a print, and the distinctness with which such details stand out from their surroundings.

Depth of field—the area wherein all things are in sharp focus and do not appear fuzzy in the resulting picture. Depth of field can be increased by stopping down the lens (which also necessitates slower shutter speeds).

Dodge—a process in enlarging whereby light is held back from an area until other details appear in the desired values on the print. Some areas may need to be dodged while others are being "burned-in."

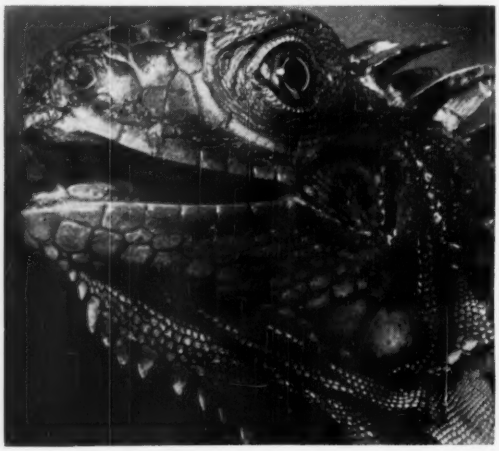
Electronic flash—a high speed flash unit consisting of the power supply (capacitor), the triggering circuit, and the flash tube (usually with a reflector). With normal electronic flash units, flash duration varies between 1/300 and 1/5000 of a second. It is especially suitable for high speed action photography.

Extension tubes—tubes of varying length, threaded to take the lens at one end and to fit into the camera at the other. They give a magnified image and make it possible to work closer to a subject than could be done with the lens mounted in the normal way.

Fixed focus—applied to cameras in which the lens is permanently

Electronic flash makes possible pictures like this saw-whet owl in flight. It was taken at 1/10,000-second exposure by G. Ronald Austing of Harrison, Ohio. It won first prize in the Kilfitt Wildlife Photo Contest sponsored by the Kling Photo Corporation of New York.

Definition is clearly illustrated in this iguana picture made by H. Sollman and entered in last year's Chicago International Nature Photography Exhibition. Notice how each scale is sharply defined. The picture is in *sharp* focus, and certainly has *impact*.



mounted, with no provision for focusing. The depth of field is from about six feet to infinity.

Frame—(noun) in motion picture usage this means one single exposure; (verb) to compose a picture so that the center of interest is seen through an opening such as a doorway or an arch. Trees, branches, clouds, or other surroundings may be used to serve the same purpose.

Fuzzy—describes a negative, print, or transparency that is not clearly and sharply focused.

Glossy—a sensitized paper surface that, when dried on a ferrotype plate, is very shiny. This surface is best for reproduction in newspapers and magazines.

High key—describes a picture (black-and-white or color) that uses only the lighter tone values and excludes all or almost all tones of middle or dark values. It is best used on subjects that are meant to convey an impression of cheerfulness, lightness, and delicacy.

Hot spot—a light or brightly colored area in a picture that distracts the eye from the center of interest and tends to spoil the over-all composition.

Impact—the first impression a picture gives; the "wallop it packs," its attention-getting qualities.

Infinity—the remote distance in a picture; for focusing purposes it is anything more than 500 to 600 feet from the lens. It is indicated by a symbol that resembles a horizontal figure "8."

Low key—makes use of the middle and dark tones to produce heavy masses and dark shadows. It lends itself to dramatic, mysterious, and rugged subjects.

Matte—a sensitized paper surface that is completely lusterless. It gives softer (and sometimes more pleasing) effects than does the glossy surface.

Mount—(verb) to paste a print on a heavy cardboard backing, or to bind a transparency in some protective covering, usually between two panes of glass; (noun) also the cardboard or the glass and masks used.

Portrait lens (also portrait attachment)—an auxiliary lens used over the regular lens to make possible the taking of close-up pictures. It serves much the same purpose as extension tubes. Nature photographers use extension tubes or a portrait lens to take insect, flower, and other close-ups.

Salon—a public exhibition of photography. It may be a one-man show, but usually it includes the work of many photographers. Standards of acceptance are high.

Salon print (or picture)—a picture of high technical quality, suitable for display in a salon. A picture may be good, and still not have the degree of "arty" quality expected of salon material.

Sharp—the opposite of fuzzy. It is a term used to describe details that are clearly in focus.

Slide—a transparency mounted for projection. The mount may be of cardboard, or the transparency may be mounted between glass plates sold for the purpose.

Soft focus—describes a picture in which objects are not sharply defined. It is an effect that is obtained deliberately, either by so focusing in the original picture-taking process, in the focusing of the enlarger when printing, or by diffusing the light as it reaches the camera lens or passse through the lens of the enlarger.

Spot—(verb). Filling in pinholes in the negative or darkening white spots on the print with an opaque medium; or, indicating the proper way of projection for a transparency, usually by marking the lower left hand corner; (noun) short for "spotlight."

Stop down—decreasing the size of the opening to the lens, thereby cutting the amount of light that passes through.

Strobe—short for stroboscopic flash. Also, more popularly, it is a term used to mean the electronic flash.

Snapshot—a photograph made with a hand camera and instantaneous exposure. More recently it has come to mean a casual photograph taken with a box or other simple fixed-focus camera.

Telephoto lens—a lens designed to give a larger image than a normal focus lens will give without moving the camera closer to the subject; it is used to take pictures of distant objects.

Vignette—the technique, in making prints, whereby the picture is faded away more or less gradually toward the edges of the paper. It is particularly effective in the printing of portraits.

Wide angle lens—a lens that permits a greater width of view than usual, and covers more than a 50- or 60-degree-wide angle of view.

Honey

(*Continued from page 153*)

had purchased her, not only as a present for our son, but also because we wanted him and the other children in our neighborhood to learn more about wild animals. To our son, she quickly became a beloved friend and teacher; and she treated the other children that came to see her in almost the same fashion, with one curious exception. Out of shyness, she would always bury her head in their arms until she knew them well. Only then would she raise her head and look around her.

But Honey's shyness was combined with the self-confidence that is common to skunks. Nature has provided these mammals with such effective protection against all dangers—except man and, curiously enough, certain owls that seem impervious to the smell—that skunks generally show no fear in any situation. On the other hand, they are not aggressors. Instead of attacking the moment they become alarmed, they generously issue a series of warnings. First they stamp their feet; then they flatten their tails over their backs; and finally, if the enemy has not yet retreated, they take aim with their rear ends. Only after these three warnings are they ready to fire. This natural instinct made it easier to handle Honey, because she, too, would stamp her feet when annoyed, so we always knew if she was being bothered by the visiting children.

She did such a good job of teaching the neighborhood children to have consideration for wildlife that she was eventually "asked" to appear on a children's program broadcast by an educational television station. Quietly she nestled in our boy's arms and then sat on a table in front of the camera, while a naturalist explained the usefulness of skunks. Judging from the letters that came to the station afterward, her appearance was a success. On another occasion, she took part in a farm show, where hundreds of children came to see her and went away better understanding her kind.

One night, during her sleep, Honey died, and in the morning we found her curled up in one of her customary resting places at the foot of our son's bed. She is now buried in the woods below our house, under a wild apple tree, with the animals and birds that we have occasionally found dead on our land for company.

Looking back, we often wonder how many human beings have accomplished as much as Honey. With her curiosity, her love for out-of-the-way places, and her affection, she filled our household with pleasure. But she did more than that. She left behind her a heritage of understanding that should mean greater safety for many wild animals in the years to come—not because of a sentimentality, but through love and respect. Certainly the children who knew her are less likely to raise their hands against the wild things of the woods and fields. Among her lessons, Honey taught the children that what they thought they most despised is actually a lovable and intelligent mammal, and she showed them that there is more of charity and graciousness under the skies than they had ever dreamed.

Easter

(*Continued from page 155*)

most of the month of March. It will enter the morning sky on March 29. It will set about an hour after the sun on March 1, and about an hour and one-half after the sun on March 15. It will reach its greatest eastern elongation on March 12; but, even on that date, it will be poorly placed for observation.

Venus will be a brilliant evening star (magnitude − 3.4). It will set 2 hours after the sun on March 1, 2 and one-half hours after the sun on March 15, and approximately 3 hours after the sun on March 31. It will be very conspicuous in the western sky during early evening.

Mars, in Taurus, will be overhead by the end of evening twilight. It will set in the northwest at about 1:30 a.m. on March 1, 1:00 a.m. on March 15, 12:30 a.m. on March 31. It will be found due north of Aldebaran at the beginning of March, but will move eastward.

Jupiter, in Scorpius, will appear to the northwest of Antares. It will rise at approximately 12:30 a.m. on March 1, 11:45 p.m. on March 15, 10:45 p.m. on March 31. At dawn, it will be seen over the south-southwest horizon, with magnitude −1.8.

Saturn, in Sagittarius, will rise in the southeast at about 3:30 a.m. on March 1, 2:30 a.m. on March 15, 1:30 a.m. on March 31. It will be seen low over the southern horizon at dawn.

Rich Weeds, Poor Weeds

EARLY settlers were wont to "size-up" the agricultural possibilities of land according to its natural vegetation. Thus, in general, tracts occupied by deciduous trees were classed as more fertile than those grown to pines. And among the soft-woods in Indiana, black walnut and pawpaw were reckoned—where I grew up, at least—as good indicators of rich land. Black locust was generally regarded as a sign of good soil. In eastern Texas, cane and wild peach were the guides and, in common speech, "peach and cane land" denoted an area good for farming. A saying was: "Where the wild peach grows, buy and grow rich."

And so it was with herbs, also. In the Lone Star State, "places where mesquite grass grows are considered to be especially fertile." Concerning Virginia, B.S. Barton wrote in his *Journal* (1802) that horse-balm or horse-weed is called rich-weed "by reason of the richness of the soil in which it very generally grows." Other plants that have won the name of rich-weed include: black snakeroot, white snakeroot, and giant ragweed. At the other extreme, the poverty-weeds embrace rabbit plantain or pussy-toes, pearly everlasting, old-field balsam, and the common daisy or white-weed.

Poor-weeds are the first to establish themselves. In the mid-Atlantic States, the daisy, dog fennel, pinweeds, and pussy-toes are among the first-comers. Then broom-sedge and brambles take possession, only to be replaced in time by sassafras and sumac, then by scrub pine, and at length by oaks and other trees of the usual hardwood forest of the region. In such ground cover the rich weeds will be found. Thus there has clearly been an increase of soil fertility. And what has caused it? The plants themselves, each set in the succession, by adding their roots to the soil and their above-ground parts to the humus, have prepared the way in soil goodness for the more demanding late-comers. Thus, all from poverty-weeds to rich-weeds in turn may grow on the same tract, but as the farmer wants to know what the land is good for now, not in the future, he is right in judging by present growth. There is much meaning in the poor-weeds to rich-weeds succession for those who can read the signs correctly.

W. L. McATEE

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Nature IN ROCK AND MINERAL

By PAUL MASON TILDEN

Minerals & Manners

NOT LONG AGO THE PRINTER, IN A playful mood, sent the editorial staff of *Nature Magazine* a handful of cards bearing in bold type the legend "Before you louse something up. . . THIMK." I do not know where or by whom this saying was originated, but it has been making the rounds for several years, and it smacks strongly of the composing room of a print-shop. If you can overlook the grammatical assault and battery, the saying is one that applies with rather painful force to the mineral collecting fraternity, which is peculiarly dependent on the good will of mine and quarry owners.

It is a sad fact that many mineral collecting trips have been "loused up" by misbehavior on the part of someone who did not think. . .or thimk, if you will. The mine or quarry that was the objective of a long day's drive is closed to all collecting. Has the owner an inborn aversion to mineral collectors, or was his attitude due to something that collectors did to his property? The chances are ninety-nine percent in favor of the latter.

Several summers ago, I was talking with the superintendent of a big feldspar mine in one of the New England States, a mine that long has been famous for the variety of fine and rare minerals that occur with the feldspar. Thousands of collectors come to visit the locality every year, and when they get there, they are politely but firmly advised that the property has been closed to collectors. I asked the superintendent what had happened to bring about this attitude on the part of the owners. I thought I knew the answers, but I wanted to hear them from the one man who was in touch with both mine owner and mineral collector.

Mine and thine

To begin with, said the superintendent, some collectors seemed to have difficulty in distinguishing the company's property from their own. Tools and spare parts for machinery disappeared with discouraging frequency. Air hoses for pneumatic machinery had been cut, and for no apparent reason. The company had had to rescue an over-zealous collector who was dangling from the face of the tremendous open pit at the end of a rope, apparently bent on securing a choice specimen at any cost. In this case, the cost was borne by the company, for mining operations had to cease while the collector was retrieved. Windows in the storage sheds often had been broken. The bill of particulars went on and on.

ILLUSTRATION BY GARNET W. JEX

"The company had had to rescue an over-zealous collector who was dangling from the face of the tremendous open pit at the end of a rope."

I suggested that it was a tiny fraction of the people who collect that caused trouble like this. The superintendent agreed, but said that since it obviously was not possible to filter out that tiny fraction, the mine had to be closed to all visitors.

This was one mine, in one State. There are thousands of mines scattered about this nation, but they all have the same problems in their relations with mineral collectors. If the avocation is to stay healthy and grow, it will be necessary for some mineral collectors to heed the advice of our printed card and THIMK!

NEWS NOTE

A mineral discovery with a conservation twist is reported from Ohio, where a veteran geologist of that State's Division of Geological Survey — Russell Brant — recently found the mineral halotrichite, the hydrated sulphate of iron and aluminum. Halotrichite is not a rare mineral, but this was the first time it has ever been detected in the Buckeye State. Mr. Brandt encountered the mineral at the mouth of a coal mine in Vinton County while he and other scientists were making a survey of coal mine wastes that are one of Ohio's worst forms of water pollution, as such wastes are highly acidic. Geologist Brant at first took the whitish mineral to be "cave alum," but chemical and X-ray analyses proved it to be halotrichite; which name, incidentally, has descended in a round-about way from the German *haarsalz*, or "hair salt," in allusion to its matted aggregates of hair-like crystals. The mineral is white or colorless, and has an astringent taste.

BOOK REVIEW

Those Astounding Ice Ages

By Dolph Earl Hooker. New York City. 1958. Exposition Press, Inc. 148 pages. Illustrated. $3.50.

The sub-title of this interesting volume is *An Exploration of Our Planet's Most Challenging Mysteries*, which seems appropriate enough, since the cause or causes of continental glaciation have so far managed to escape the positive identification of the most ingenious investigators—including, we think, the author. Dolph Earl Hooker, architect, engineer, lumber dealer and glaciologist puts forth the premise that glacial ice has appeared from time to time on our earth with catastrophic suddenness, and that it destroyed animal life on practically a moment's notice. This is the first theory, says Mr. Hooker, not evolved out of pure imagination. An eye-opener for the orthodox thinker on subjects glaciological, at any rate, and is certainly well worth reading.

MINERALS FILMSTRIPS

A new series of three filmstrips in color has recently been released. Entitled "Minerals on Parade," the series deals with the elementary study of the minerals of the earth's crust. It is designed for primary and secondary schools. The author of the filmstrip series, Ronald E. Januzzi, has based both the films and the accompanying teaching text booklet on books he has written both for children and for teachers, and from information he has gathered as a collector and lecturer. Part one shows where and how mineral specimens are found, equipment necessary to find and identify minerals, safety precautions, and various tests to identify minerals. Parts two and three picture actual specimens of about forty minerals most commonly found, and their commercial uses. The price is $24.00 for the set of three film strips and teaching text booklet, with fifteen percent discount allowed to schools. The series is produced and distributed by Sweetman Productions, of Bethel, Connecticut.

Bulletins

"The Program to Eradicate the Imported Fire Ant," a 40-page report to the Conservation Foundation, of New York City, and the New York Zoological Society by Dr. John L. George of the U. S. Fish and Wildlife Service, is a record of Dr. George's preliminary observations on the imported fire, the current control program, and its biological and economic effects. The address of The Conservation Foundation is 30 East 40th Street, New York 15, New York.

"Flower and Feather" for January, 1959—an issue of the quarterly publication of the Chattanooga, Tennessee, Audubon Society—features an interesting story on the plant known as "the Apple of Peru," and how this plant, sometimes known as the "fly-poison plant," was used by early American settlers for the purpose suggested by the name. Robert Sparks Walker, editor of the magazine and executive secretary of the Chattanooga Audubon Society, does this little story in his usual homespun, entertaining way. A subscription to *Flower and Feather* costs $1.00 per year, which sum includes a membership in the Society. The address is 808 South Greenwood Avenue, Chattanooga, Tennessee.

"Botany and Zoology Catalogue 101," is a 32-page price listing of books on botany and zoology, old and modern, that are carried in stock by bookseller Eric Lundberg of Walpole, New Hampshire.

"Planning School Forests," by Dr. Carl S. Johnson, assistant professor of conservation at Ohio State University, presents a "realistic and practical approach" to the use of school forests as laboratories for outdoor education. This pamphlet points out sources of advice and assistance in establishing and maintaining school forests, describes some Ohio school forests that are already being used as outdoor laboratories, and is designed to be of use to both large and small, city and rural, schools. Twenty-five cents, from the Ohio Forestry Association, Inc., Southern Hotel, Columbus 15, Ohio.

"The Fraser Fir as a Christmas Tree" is a publication of the U. S. Forest Service that points out the advantages of growing the Fraser fir as a holiday tree. Discusses the size, form and growth of the Fraser fir, nursery practice, seed collecting, planting recommendations, stump culture, and other aspects. By W. K. Williams, Extension Forester, U. S. Department of Agriculture, and available from the Superintendent of Documents, Washington 25, D. C., for 10 cents.

Toward Ideal Trees

During the past seven years, progress in the science of forestry genetics toward the production of superior trees has been quite rapid, says Dr. Bruce J. Zobel, associate professor of forest genetics at the School of Forestry, North Carolina State College. For example, the relationship between seedling and mature tree has been worked out in some cases, enabling prediction of the character of mature tree wood properties from the character of the seedling. But real success in the genetic control of wood characterists must await further studies of pest resistance, physiology and growth patterns, says Dr. Zobel.

Wildlife Conference

The setting for the 24th North American Wildlife Conference, sponsored annually by the Wildlife Management Institute of Washington, D. C., will be the Statler-Hilton Hotel in New York City, March 2, 3 and 4. The general theme for this year's sessions will be "Resources, People and Space." The general session for March 2 will be *Better Living for a Growing America*, under the chairmanship of Karl T. Frederick of the New York State Conservation Council. For March 3, the general session will concern *Billion-Dollar Questions*, with Eldon L. Johnson, president of the University of New Hampshire, as chairman. Under the chairmanship of Roger D. Hale, vice-president of the Conservation Foundation, of New York City, the March 4th session will be devoted to *Urban, Rural, and Wild Land Planning for a Better America*. Technical sessions are scheduled for all three days, during which many phases of restoration and management of natural resources are to be discussed. The Conference is open to all interested persons.

Just prior to the North American Wildlife Conference—from February 27th to March 1st—the 23rd annual convention of the National Wildlife Federation will be held at the Sheraton-McAlpin Hotel in New York City, with an attendance of delegates representing some fifty affiliated wildlife federations and conservation leagues in the United States and Hawaii. A panel discussion of problems resulting from the application of chemical pesticides will highlight the opening day of the convention, with Dr. Clarence Cottam, director of the Welder Wildlife Foundation at Sinton, Texas, and a former assistant director of the U. S. Fish and Wildlife Service, as moderator. The panel will touch on all phases of insect and plant pest chemical controls, including the current highly controversial fire ant program in the South.

Bold Rescue

During the past winter, the ice has been thick in the bays and estuaries of the East Coast. Just before Christmas the crew of the tugboat *Cavalier*, making its way through the ice floes of Chesapeake Bay, spotted a deer marooned on a five-foot-square piece of ice some four miles off shore. The tug was maneuvered to within about twelve feet of the chilled mammal, which was lassoed by Captain Perrin Cudworth and brought aboard. A canvas was wrapped about the 225-pound deer, and apples, cabbage and collard greens furnished its first meal for some time. At Norfolk, Virginia, where the tug made port, two State game wardens took charge and the sea-going deer was taken to the Dismal Swamp and released, none the worse for an unusual mammalian escapade.

Bulletins

"Grass-Roots Conservation," by the late Walter Robert Sylvester, associate professor of conservation at Wisconsin State College, is a study of conservation programs affecting private land-use practices in middle Michigan, with criteria for evaluating land use, climatic problems, soil problems and land-use programs and agencies. This volume contains 210 pages, with an extensive bibliography, and a limited number of copies are available from the Department of Conservation, School of Natural Resources, University of Michigan, Ann Arbor, Michigan.

"Minnesota's Forest Resources," Forest Resource Report No. 13 of the United States Department of Agriculture, is by R. N. Cunningham, A. G. Horn, and D. N. Quinney of the Lakes States Forest Experiment Station, and is a field inventory of the area, volume, growth, and drain of the forest resources of that State. It is available from the Superintendent of Documents, Washington, 25, D. C., for twenty-five cents.

"Birds of Longwood Gardens" is publication number three of *Longwood Favorites*, published by Longwood Gardens, Kennett Square, Pennsylvania. (Previous publications have been *Calendar of Flowering* and *Tree Ferns*.) *Birds of Longwood Gardens* has been made possible through the cooperation of the West Chester Bird Club and the Longwood Gardens Education Department, and is a bird listing based on a one-year survey by members of the Club. This is a superb publication in every respect, illustrated with full-color and black and white bird and other illustrations. Longwood Gardens, 12 miles from Wilmington, Delaware in Chester County, Pa., is one of the country's distinguished showplaces with its arboretum, flower gardens and other attractions, and was developed by the late Pierre S. Du Pont.

"Analysis of the Wilderness Bill" is an 8-page folder, prepared and published by the National Wildlife Federation, that sets forth in simple, every-day language the purposes of the Wilderness Bill as revised and introduced late in the 85th Congress. Set up in adjacent columns, the non-technical explanatory matter follows the wording of the bill in readable sequence. A copy may be requested from the Federation at 232 Carroll Street, N. W., Washington 12, D. C.

"Redwoods Away," by Dr. Ernest E. Stanford, until 1958 the chairman of the department of botany at the College of the Pacific in Stockton, California, is a most interesting reprint of a lecture by Dr. Stanford concerning the wanderings of the coast redwood and the Sierra redwood of California. The *Sequoias* have been propagated in many parts of the world, and this 28-page booklet tells of the successes and failures that have attended such attempts. It may be requested from the department of botany at the College of the Pacific.

"The Nature and Extent of Leadership in Conservation Education in State Agencies—1956-1958," by Richard L. Weaver, associate professor of conservation and conservation education in the School of Natural Resources of the University of Michigan, is the printed result of a study, by means of questionnaires and personal visits, of all state-level education and resource agencies in the various States to determine the nature and extent of leadership in conservation education during the indicated years. A limited number of copies are available from the author at the School of Natural Resources, University of Michigan, Ann Arbor, Michigan.

"The Water Pollution Control Program of the U. S. Public Health Service for 1957-1958" is a report on the progress that has been made toward control of water pollution in the United States under the Federal Water Pollution Control Act, during the years 1957 and 1958. It is Public Health Service Publication 631, contains 26 pages profusely illustrated in color, and is available from the Superintendent of Documents, Washington 25, D. C. The price is twenty-five cents.

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Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

The Sperm Factory

IN THE PRECEDING INSTALLMENT OF these columns the cyclic changes within the ovary, leading to formation, growth, and expulsion of the eggs, was described. So it is fitting to take up next the story of the companion organ, the *testis*, where sperm cells are produced. The word is an original Latin term for this structure, and implies a cup or vessel; *testicle* is the diminutive; *spermary* is a much better designation, as it corresponds with ovary, but unfortunately is used only for certain animal groups, chiefly insects.

Just as we have seen that there is a favored animal to select in preparing sections of the mammalian ovary—the cat—so there is also a preferred form for the testis, in this case the rat. Specimens are readily obtained and the sectioning and staining are done by routine methods, hematoxylin and eosin being employed for general studies, iron hematoxylin alone or with eosin for superior slides that permit observation of chromosome behavior.

One of our illustrations shows an entire rat testis in section; the other is an enlarged detail from the first. The whole organ is seen to be essentially a collection of tubes in cross section. In the photomicrograph under higher magnification, the tissue between the tubes is more readily inspected and the cells of both the tubes and the partitions between them are evident.

Development of the testis

Some information on the development of the testis will clarify the adult structure. At first the ovary and testis are alike, and in this indifferent period the term *gonad* is used to embrace both. The gonad appears as a swelling or protrusion into the body cavity (coelom) from the dorsal body wall of the embryo, one on each side of the midline, and extending a long distance from front to rear. This is the urogenital ridge, and it soon differentiates into a lateral urinary and a medial genital portion. The peritoneum thickens and makes a strip of tissue that is the first indication of the future gonad. The thickened lining of the coelom is the *germinal epithelium*. Its role as the progenitor of eggs in the female is definite, but is less well established in the male. Presumably the *testis cords* develop from this external layer, although their first recognizable appearance is a sudden flowering within the tissue of the future testis, unconnected with the peritoneal lining.

The testis cords are conspicuous rows of epithelial cells, branching and anastomosing within the bulge of tissue that will become the testis. They are solid until the onset of puberty, when they canalize and are thence called the *seminiferous tubules*. These are arranged radially, converging toward the attachment base of the organ, the supporting membrane called the *mesorchium*. The more peripheral portions of these glandular tubes are highly meandering (tubuli contorti) while their basal divisions are straight (tubuli recti) and join a complex network of canals (rete testis), these in turn continuing into the epididymis, in which the trajectory is likewise greatly convoluted. If all the tubules of this system in adult man could be joined end to end and unraveled, they would measure hundreds of meters in total length. This vast amount of folding is one of Nature's commonest methods for obtaining a very large amount of cell surface for secretion, excretion, or absorption, within a limited mass.

The human testis, for which the rat preparation is the usual stand-in, becomes divided into lobules with one to three tubules per lobule. They radiate away from the base, separated by partitions, the *septula*. These are of connective tissue and contain *interstitial cells* that are presumed to be the source of the male sex hormone, testosterone, which regulates male characteristics, activated by a secretion from the pituitary gland. Several of these interstitial cells show as large pale bodies in the septula seen in the more magnified of the two illustrations.

The epithelium of the seminiferous tubules contains two kinds of cells, sex cells and *sustentacular cells* or *cells of Sertoli*. The Sertoli cells are presumed to aid in nourishment of the developing sperms. Within a single tubule, the oldest sex cells are at the periphery, the youngest at the central lumen (cavity). Note that the cells at the outer border are smaller than those of the next row inward. The outermost cells are *spermatogonia*, derived from the primordial sex cells of the germinal epithelium. They multiply throughout life by ordinary mitosis and supply the almost endless series of generations of sperms. Any certain one of these, after repeated mitoses, ceases to divide and proceeds to grow to a much larger size, whereupon it is termed a *primary spermatocyte*. Chromosomes soon become evident in these cells.

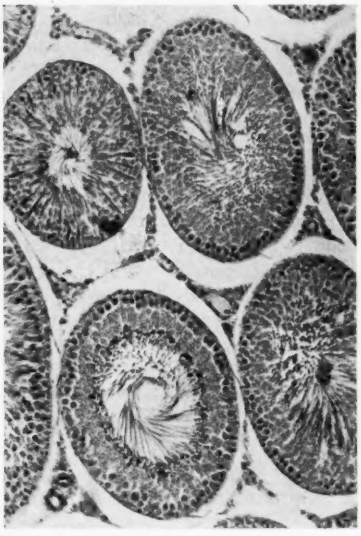
Rapid cell divisions

Now two rapid and successive cell divisions of a peculiar sort ensue, designated as meiosis and occurring in the period of maturation. In the first of these divisions the characteristic chromosome number for the species is reduced by half, from the diploid condition to the monoploid (haploid); in man from 48 to 24. The 48 are more precisely stated as 24 pairs, and among them is the pair of sex chromosomes, the X-Y. During this reduction division the X-chromosome will pass to one pole of the meiotic spindle, the Y to the other. Hence one-half of the

Cross section of entire testis of rat, 11X.

resulting sperms will contain the X, the other half the Y. Ovocytes have X-X, each mature ovum a single X, all eggs being alike in this respect. If an X-containing sperm fertilizes an egg, the result will be X-X, producing a female offspring; if a Y-containing sperm fertilizes an egg, the zygote will have the X-Y combination that will develop into a male. Thus sex is determined by chance, at the moment of fertilization.

Each primary spermatocyte divides into two *secondary spermatocytes*, and each of these in turn forms two *spermatids*. The second meiotic division entails no further reduction of the chromosomes, and the spermatids



Detail of rat testis, 210X.

(Photomicrographs from slides loaned by Ward's Natural Science Establishment, Inc.)

are destined to be the end of the line, never dividing again. Instead, each then proceeds to transform through a series of changes in shape and in arrangement of parts into a *spermatozoön*. The stages through the spermatid are comprised within the title *spermatogenesis*, and involve the nucleus, with its chromosomes; those after the spermatid, concerned chiefly with alterations in the cytoplasm and centrioles, are designated as *spermiogenesis*. The full title for the final cell, spermatozoon, is now generally shortened to the simpler form, sperm cell, or simply sperm. Some authors use *spermium*, plural spermia.

Cells are larger

In the illustration, the second row of cells from the outer boundary of a tubule is made up of cells that are noticeably larger than those of the basal row; they are the primary spermatocytes. Various stages of meiosis follow in passing inward, and toward the lumen are many small black bodies, the heads of sperms in various stages of spermiogenesis The sperm tails protrude into the lumen, generally in a spiral swirl. When mature they break off from their Sertoli cell and go floating away toward the outlet of this duct system. They are continually renewed, throughout the active reproductive period, by movement of cells from the dividing spermatogonia toward the inner lumen, with the same cyclic changes. Each spermatogonium thus gives rise to four daughter cells, the sperms. Cytological details of spermatogenesis and spermiogenesis were described and illustrated in this department in the March, 1947, issue of *Nature Magazine*.

In the third month of fetal life a capsule for the testis begins development underneath the germinal epithelium. This is the *tunica albuginea*, which gradually becomes a thick fibrous sheath, carrying a vascular layer within. It is seen as the outer layer in the illustration of the entire testis. When it has differentiated, the germinal epithelium reverts to the status of an ordinary peritoneal lining and remains in place when the testis later withdraws. This departure, known as the *descensus testis*, is a strange phenomenon that occurs only in certain mammals. In man the descent into the scrotum takes place from the seventh to the ninth month of gestation, and brings the testes into a region of lower temperature, essential for the maturation of sperms. A person with undescended testes is a *cryptorchid* (hidden testes) and is sterile. In whales, elephants, and some others, whose body temperature is lower than in man, the testes do not descend at all, while in shrews, rats, and bats they descend only during the breeding season, and then withdraw to the body cavity until the next cycle.

Book Reviews

Integrated Principles of Zoology, by Cleveland P. Hickman, DePauw University. C. V. Mosby Co., 3207 Washington Blvd., St. Louis 3. 1955. Pp. 956; figs. 442. $6.50.

A remarkable book in many ways. Very well organized and written; illustrations from fair to excellent. Our chief criticisms first: book too long; a large amount of repetition because principles taken up first, before any discussions of animal types; when phyla are taken up, general survey and principles again first, before student has any material on forms. This seems to us the cart before the horse; student must go back and re-read. General tendency to use technical terms without definitions; no glossary. Terms should be defined when first introduced. A number of patent mis-statements, probably due to poor proof reading.

Contrariwise: as would be suspected from length, thorough coverage of all aspects. Some striking innovations not found in other texts. After each of the thirty chapters on phyla, a derivation of basic terminology. Chapter on history followed by "Books and publications which have greatly influenced the development of zoology," with twenty-nine annotated entries. This in turn followed by 154 entries on "Origin of basic concepts and key discoveries in biology," with everything from the ancients to DDT, including list of Nobel Prize winners.

Physiology and chemistry handled perfectly, neither too elementary nor too advanced. Interesting separate chapter on transition and borderline forms. Author strikes right level of writing; comprehensible to anyone, but not written down. Prospective adopters of a general zoology text should consider this book.

Man and the Animal World, Weimer, Wiley, reviewed in this department, March, 1954.

General Zoology, by Claude A. Villee, Harvard; Warren F. Walker, Jr., Oberlin; Frederick E. Smith, Michigan. W. B. Saunders Co., W. Washington Sq., Philadelphia 5. 1958. Pp. xix, 877; figs. 457. $7.50.

A beautiful book by three authors who are well known in their respective fields—cellular physiology, vertebrate morphology, and invertebrate physiology and ecology. Dr. Villee's *Biology* is now in its third edition and is a highly successful work. The present volume is in five parts: general concepts (introduction, history, methods, cells, tissues, cell metabolism, general physiology, reproduction); animal kingdom (survey of all phyla); vertebrates (frog, vertebrate classes, morphology and physiology of organ systems, development of mammals); genetics and evolution; ecology, adaptation, parasitism, conservation. Appendices: detailed synopsis of animal kingdom, bibliography. Coverage thorough, illustrations adequate in number, well selected, superior in execution. An excellent example of printing and binding.

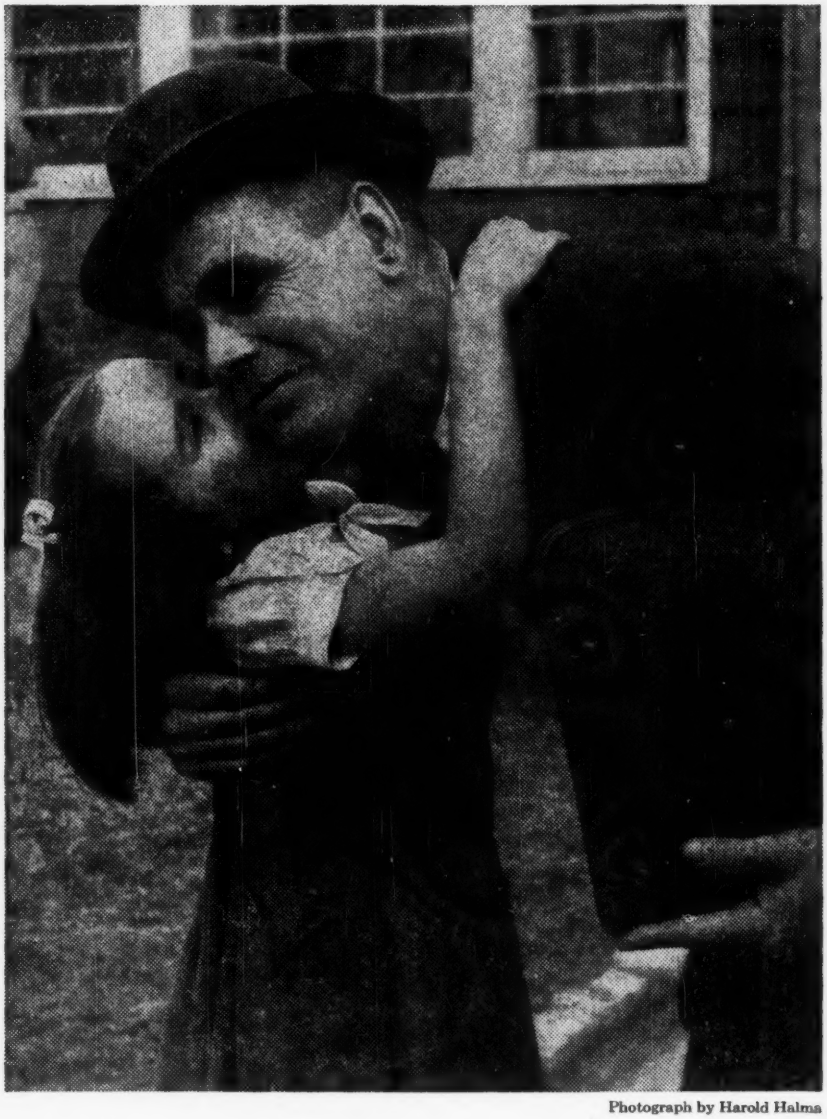
Criticisms: writing is too dry, factual, condensed; lacking in the element of charm, that would induce the student to read on and on because of aroused interest. Here, he must read only to cram an endless succession of facts. Unquestionable authority and up-to-date, with latest findings and opinions, but authors attempt too much; a shotgun book that skims all the cream off advanced courses. If student knew everything between these covers, there would be no further need (save for laboratory experience) to take comparative anatomy, physiology, histology, embryology, genetics. We prefer a book that tells less but tells it in more detail and in a more engrossing and stimulating manner.

The prospectus stresses flexibility; that the user may begin with amoeba or the frog; that the text is suitable for either a one- or a two-semester course. Our own belief is that such an aim is impossible of attainment, and that the material presented is far too comprehensive for the usual one-semester course. As a single-volume reference work, this book has no equal. In the hands of the superior, mature student, genuinely in search of information, it can give him all that is worth knowing by way of an introduction to the whole field of zoology.

Postmor Temquotes

Miranda. O, wonder!
How many goodly creatures are there here!
How beauteous mankind is! O brave new world,
That hath such people in't!
Ferdinand. O. K., my love,
But hast thou scanned this entering premed class?
O brave new world, thou wilt indeed require
Stringent fortitude! God speed thee!
Gonzalo. Amen!
—*The Tempest*, V, 1.

HELP US K[illegible] THINGS WOR[illegible] G



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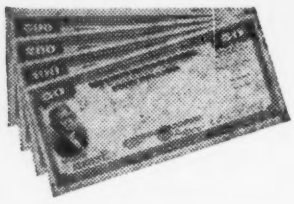

Photograph by Harold Halma

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